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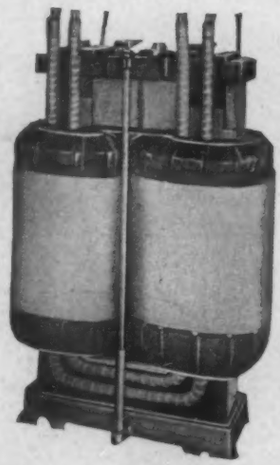

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A 40,000 VOLT POWER TRANSMISSION IN LOMBARDIA

One of the most interesting high-tension, three-phase power transmission in Europe, of recent construction, is that utilizing the hydraulic power available at the upper part of the Serio River. This mountain stream rises in the "Monti Orobii," discharging into the Adda River after flowing about 100 kilometers through the Seriana Valley.

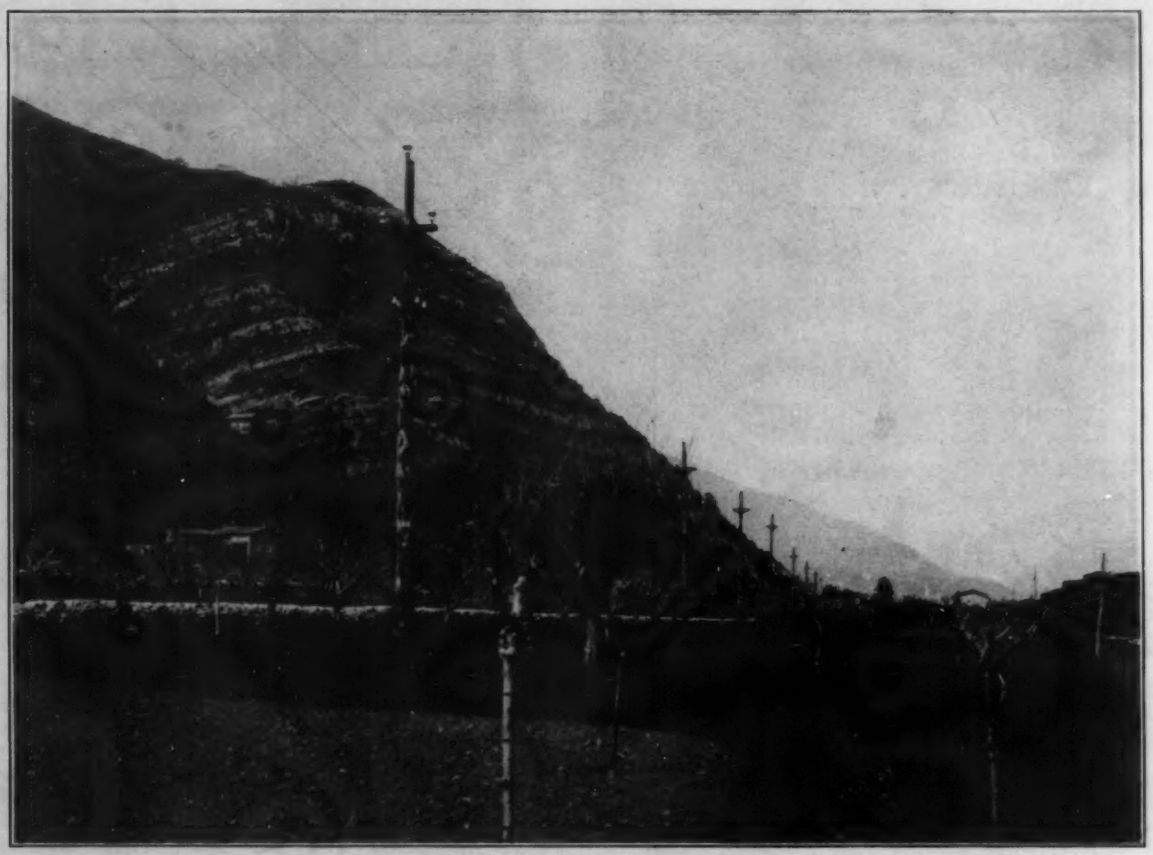
It was decided by the European engineers to take advantage of two waterfalls, each capable of supplying 2,000 horsepower in utilizing and developing the water power of the "Val Seriana," one of these being located at Gromo, and the other some distance further up.

The accompanying illustrations show the hydraulic and electrical equipment at the Gromo plant, the 40,000-volt power transmission line conducting the current a distance of thirty-five kilometers to Nembro, and the transforming and sub-station apparatus for distributing the power to the spinning mills and other industries in that section of Lombardia.

The power house is equipped with three turbines of 1,000 horsepower, each constructed by Escher, Wyss & Co., of Zurich, Switzerland, these turbines being directly connected to the electrical generator by Zodel couplings. There are also two smaller turbines directly coupled to direct-current dynamos of twenty-five kilowatts each, for supplying exciting current to the fields of the alternators.

Each electrical generator supplies current directly to the primary winding of a step-up transformer of 850 kilovolt amperes. The high-tension current at 40,000 volts is conducted from the secondary terminals of the transformer of each unit to the high-tension busbars for parallel operation with the other units, and the paralleling is thus accomplished by special switches in the high-voltage transformer circuits.

The electrical equipment was installed by Brown, Boveri & Co., of Baden, Switzerland, and these Swiss engineers term this method of grouping the three units, a hydro-elec-

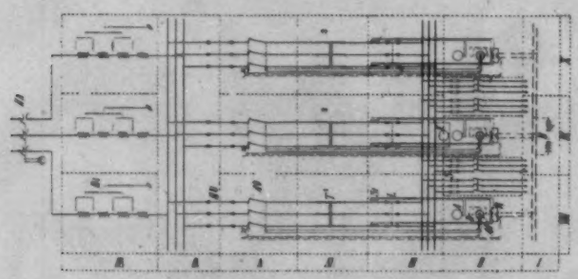


CURVE OF GROMO POWER TRANSMISSION LINE AT THE DEL RIO BRIDGE

tric transformer set. The turbine, in connection with the generator and transformer, is operated in this manner at the 20,000-volt Como hydro-electric plant, and they consider this an epoch in central-station service of this character.

These Swiss engineers hold that by cutting out the busbars between the transformers and the generators, only one-half of the controlling and measuring instruments and devices are required. It is stated that from the 4,000-volt side, the current and tension transformers are energized for the overload relays of the automatic switches, as well as for the ammeters and volt-meters. The volt-meters and ampere-meters indicate simultaneously the tension, as well as the current, when it is remembered that the ratio of the transformer is as 1:10, and by paralell running, also, the phase difference of both the 40,000-volt and 4,000-volt circuit, a cheaper construction of transformers also being allowable by this lower voltage.

It is maintained that perfect isolation of each group is possible, as the generating set is provided with disconnecting links between the busbars and the high-tension switches for 40,000 volts. By means of a special device the high-tension oil switch can be released electrically or mechanically by hand, or by a double-pole overload relay, which is fed by a current transformer branched on the



ELECTRICAL CONNECTION OF TRANSFORMERS AT SUB-STATION

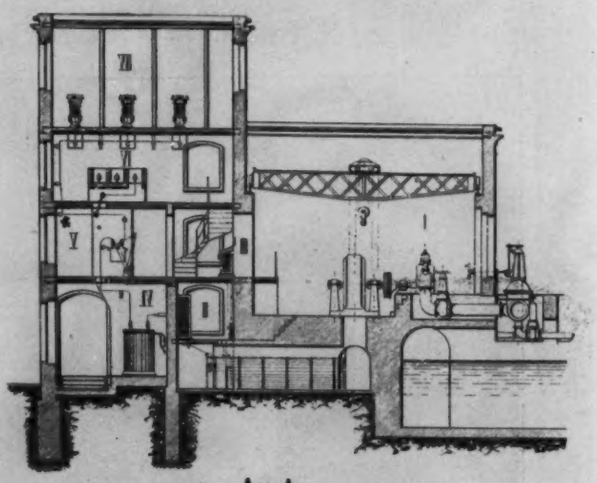
4,000-volt side. From the busbars there is only one feeder line, and it is stated that no fuses are used in the exciter circuits while the current is taken from the exciter busbars for the tripping coils of the high-tension oil switches.

The transformation ratio of the transformer is from 4,000 to 40,000 volts, and the efficiency is 97.8 per cent on non-inductive loads. The current has a frequency of fifty periods per second, and the transformer apparatus is tested to 67,000 volts between the secondary and primary. These transformers of 850 K. V. A. are 2.18 meters high, and occupy a floor space of 1.6 meters by 1.36 meters. The step-up transformers are of the water-cooled oil-insulated type, about 18 liters of water being used per minute, of 18 degrees centigrade, for cooling. Soft-iron yokes are utilized for holding together the three vertical parts of the transformer, the coils being wound in the form of concentric cylinders. A very high-grade and heavy insulating partition is used for separating the primary and secondary windings, the high-tension coils being so interwoven that there is only 300 volts difference of potential between each sub-division.

The three-phase alternators are of the horizontal-shaft construction, with revolving fields and stationary armatures with star-connected windings. These three-phase alternating generators are of the 12-pole type, and supply a current having a frequency of 50 cycles per second, and a pressure of 4,000 volts, when operated at a speed of 500 revolutions per minute.

On a power factor of .80, the normal output is about 1,000 horsepower, and the efficiency at this load is 93 per cent, including the losses of excitation. When the generator is operated at half-load the efficiency is 90 per cent and the drop in voltage is said to be 70 per cent on a power factor of unity from no load to full load, and 20 per cent on a power factor of .80. These alternators weigh about 13 kilograms per horsepower output, or a total of about 26,000 pounds.

The exciter dynamos have an efficiency of 88.5 per cent at half-load, and 90 per cent at full load, a slotted drum armature being employed and a cast-steel dynamo frame with six poles of soft-iron laminations. These direct-current dynamos are driven at a speed of 800 revolutions per minute, and generate a current of 217 amperes at a pressure of 115 volts, each set developing about 25 kilowatts.



GROMO 40,000 VOLT HYDRO-ELECTRIC POWER PLANT

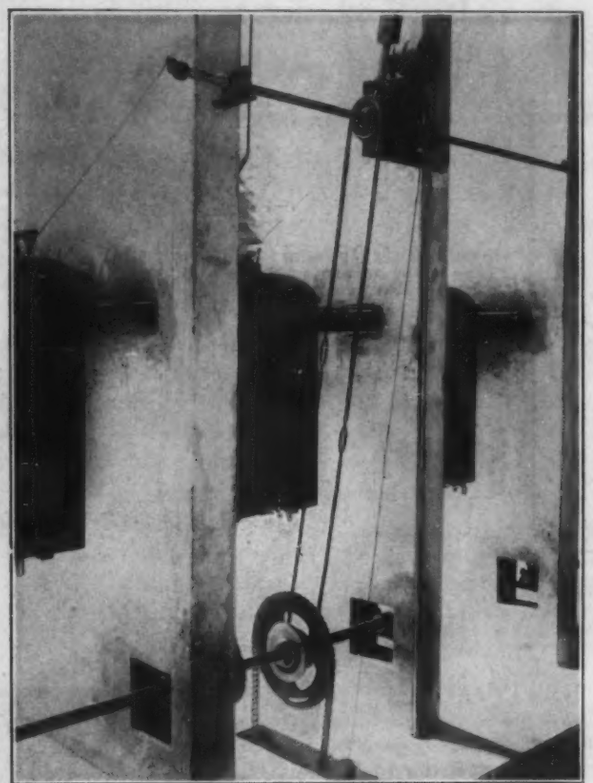
One of the most interesting features of this power transmission is the switchboard transmission line and step-down transforming apparatus.

The accompanying diagrams and illustrations show the connections and construction of this high-tension switch gear and transforming apparatus. At Gromo the switchboard apparatus is installed in a separate building from the main turbine and generator room, each of the three floors provided occupying a space of 10x7 meters, the basement of the switch-house being divided into two parts, one of which is 2.7 meters above the main generator room, and the other 1.2 meters below the main-floor level, and containing the regulating rheostats and the transformers.

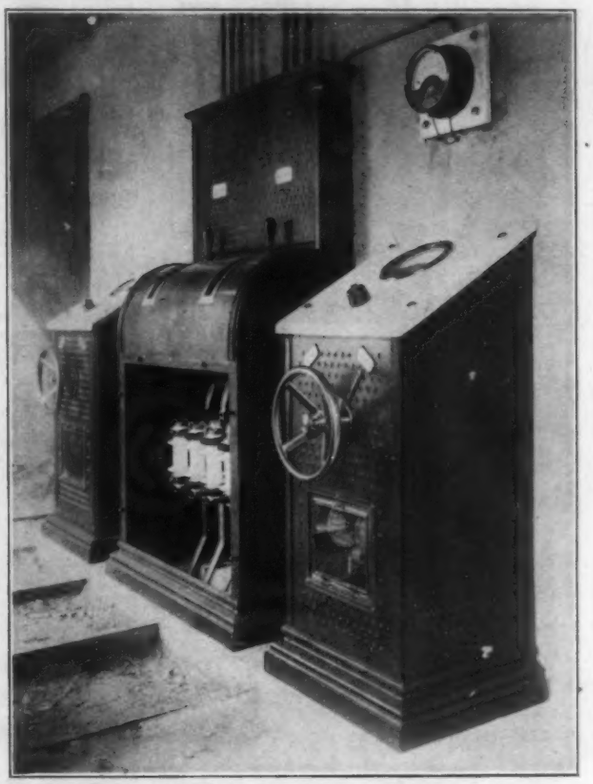
There are also two rooms in the first floor of the switch-house, one of which forms a sort of gallery overlooking the turbine and generator room, this part being equipped with the measuring instruments, switch levers and controlling wheels of the main operating switchboard. The other room of the first story contains the high-tension automatic switches and the three transformers.

The lightning arresters and out-going conductors and connections are installed on the third floor. Specially-constructed insulators are provided for use on the 40,000-volt leads in this power station, as shown in the accompanying figures. There are two current transformers and one potential transformer, also three high-tension, single-pole

tube fuses, with blow-out horn carried on the framework of each generator. A riveted iron structure is utilized for this framework, embossed sheeting being used for covering the lateral side, with removable shields in front for examining or renewing the fuses. Glass tubes are cemented into the dividing wall, through which the leads enter the transformer room. Each phase of the 40,000-volt busbar apparatus has enclosed separate cells of fireproof material, the walls being 120 millimeters in thickness. The insulators are tested to 100,000 volts, and the high-tension oil switches are located on the first floor, below the high-tension busbars, a separate switch being utilized for each phase, all of which being so arranged as to work together. A common driving spindle is provided for these automatic high-tension switches, two of which belong to the three-pole switch of an hydro-electric transforming set, as it is called, and the other to the three-pole switches of the leads. The fireproof



DRIVING SPINDLE FOR THE SWITCHES AT THE GROMO POWER PLANT



SWITCHBOARD FOR THE PRIMARY AND SECONDARY TRANSFORMER SIDE AND FOR THE 500 VOLT FEEDERS

cells in which the switches are installed are 600 millimeters wide, and the connections pass through the top through an opening from the switches to the busbars. By means of a rotating motion the switch is operated from the distant main board by a hand-wheel, multiple break switches being employed, an oil bath submerging the stationary as well as the moving contact. When it is desired to get at the electrical contacts, the oil cases may be lowered out of the way without difficulty.

The high-tension transmission line from the Gromo power house to the Nembro sub-station is 32 kilometers long, and follows along the banks of the Serio River. The power is utilized for driving the cotton machinery of Crespi & Company, of Milan, and the power-transmission line to Nembro is capable of carrying 4,000 horsepower. With this amount of power the drop will not exceed five per cent, it is stated, the line consisting of three bare copper conductors mounted on Delta insulators, the wires having a diameter of 6.5 millimeters.

The longest span on this transmission line is 120 meters and the sharpest angle is 145 degrees, the transmission line to Nembro crossing a canal and another power transmission line at Albino, as well as a single-phase line of 2,000 volts at San Carlo.

At the Nembro sub-station the three-phase current enters from the Gromo hydro-electric station at a pressure of 38,000 volts. Provision is made for three step-down transformers, two having been already installed of 500 K. V. A., with a ratio of transformation of 38,000/500 volts.

These step-down transformers are the same oil-insulated, water-cooled type used at the Gromo hydro-electric plant, and they have an efficiency of 97.6 per cent on non-inductive full load. The regulation on a power factor of .70 was found to be 2.8 per cent, and the inherent regulation was found to be .8 per cent on non-inductive full load.

These step-down transformers take 13 liters of water per minute for cooling for each unit, and they occupy a space 2,005 millimeters high, 1,155 millimeters wide, and 1.6 meters in length. The switching apparatus and the electrical connections at the Nembro sub-station are similar to those at the Gromo power house, and therefore a detailed description would be superfluous. In this transformer station there are two stories and a basement, the ground floor being divided into two compartments, in one of which the transformers are installed. The high-tension, automatic switches are mounted on the next floor above the transformer, and in the front room there are two desk panels for the high-tension switches; also a 500-volt distributing feeder panel. The high-tension busbars of 38,000 volts are practically the same as those at Gromo, and the lightning arresters, also of the same construction, are located in the next compartment. This power transmission plant is said to be giving most excellent satisfaction, and is very economical in operation.

STANDARD METHODS IN PIPE FITTING.*

By G. I. Vincent.

In compiling data for standards for house fitting, service, meter and appliance connections, the writer has drawn largely from the published experiences of others, particularly the answers to the questions of the Practical Class of the American Gas Institute. The practices shown in these answers, and, in fact, in most of the literature on the subject, were, however, developed largely through distribution work in large cities, and the writer has introduced a number of modifications which have been found more applicable to towns and cities of the Middle West. The work is neither complete nor final, and it would seem that there was in this subject sufficient work of interest to

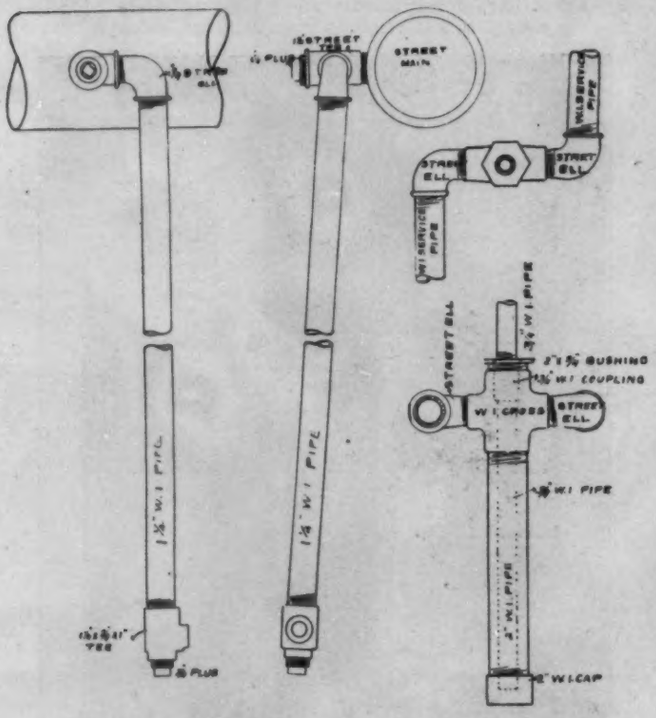


FIG. I. STANDARD SERVICE CONNECTION

FIG. II. SERVICE DRIP

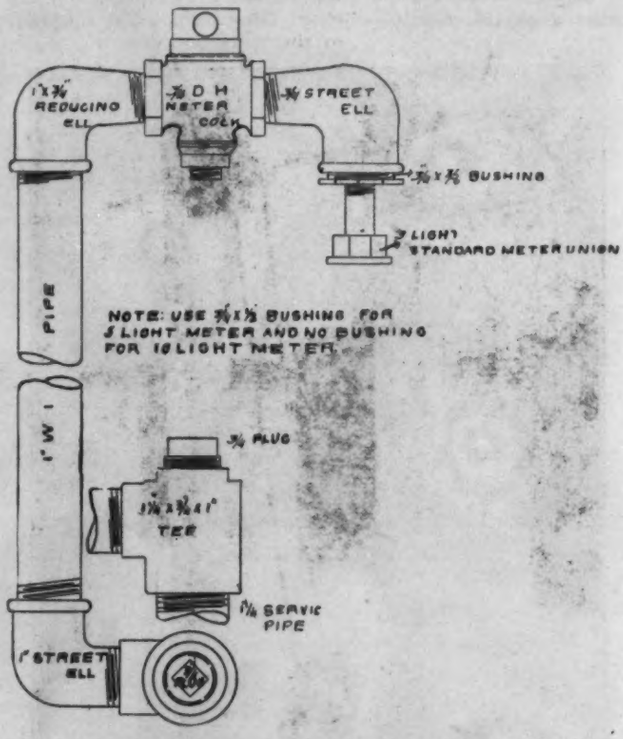


FIG. III. IRON INLET CONNECTION FOR 3, 5 OR 10 LIGHT METERS

shown in Fig. I. The advantages of this form of connection have been given very often, but may be mentioned again briefly.

1. The swing joint gives the grade to the service without straining the pipe or fittings, and gives a slight flexibility to the service in use.

2. The plug in the street tee enables the gas to be shut off during installation until the service is completed.

3. The plug in the street tee gives a clean-out at the street end for bad stoppages.

4. The plug at the house end gives a clean-out for all ordinary stoppages.

The sizes given in Fig. I are for ordinary services. It is now generally admitted that it is poor practice to run smaller than 1¼-inch services. For larger sizes the same method should be used, but the plug at the house end should always be ¾-inch or bushed to ¾-inch. This is to give a uniform size for connecting a force pump.

this association, that a committee might be appointed to continue it.

Before taking up the matter in detail, let us consider the subject of standards in general. The question is often raised as to the value of standardizing work, particularly when applied to such a highly varied industry as gas-pipe fitting. There is no question in any one's mind as to the value of certain general standards, as, for example, the U. G. I. standard screw threads and pipe threads. The principle underlying the standardizing of any work is precisely the same as the standard thread. Both are processes of evolution with ultimately greater economy as the final goal, and it is the opinion of the writer that the adoption of standards in fitting work will necessarily result in greater economy, both in installation and operation. However, we have as yet no standards, and their development, particularly in this section of the country, is not very far along. The methods to be given in this paper should therefore not be called standard, as, while they are largely developed through long and good engineering practice, they are still open for discussion.

Service Fitting.—The standard service connection is

For connecting to the side of the main, use the same swing joint with the ell laid parallel to the tee.

It is poor practice to drill large holes in small mains, and, where necessary, the main should be strengthened by a split sleeve. It is customary and good practice, to sometimes drill a smaller hole in the main than the size of the service, in connecting to small mains, but in this case the reduction should be made in the male end of the street tee only. A schedule of service connections is given in Table I. Service split sleeves are standard castings, and come in all sizes, from 2-inch to 8-inch. To avoid multiplication of fittings, a full line of sizes of tap holes is not provided for each size main, and bushings are used to reduce, where required. In place of the service split sleeve, an ordinary split sleeve, as used for repairing leaks, tapped to the size required, may be substituted.

In connecting services to wrought-iron, low-pressure mains, the main may be either cut out and a fitting inserted, or a sleeve or saddle used. Cutting the main is satisfactory only for small mains—say 2-inch and less. It is poor practice to drill and tap a hole in wrought-iron pipe.

Drips on services should be placed outside of the building, for two reasons:

*Proceedings Iowa Gas Association.

1. Danger of freezing and bursting inside.

2. Annoyance caused by possible spilling of the liquid when emptying.

Table I—Schedule of Service Connections.

Size of Service Inch.	Size of Main, Cast Iron, Inches. 20	16	12	10	8	6	4	3	2
	Size of Hole, Inches.								
*1	1	1	1	1	1	1	1	¾	1½SS
1¼	1¼	1¼	1¼	1¼	1¼	1¼	1	¾	1½SS
1½	1½	1½	1½	1½	1½	1½	2SS	1½SS	1½SS
2	2	2	2	2	2	1½	2SS	1½SS	1½SS
2½	2½	2½	2½	2½	2	3SS	2SS	3x3T	
3	3	3	3	2½	3SS	3SS	4x3T	3x3T	

Note—1½ SS = Split Sleeve tapped with 1½-inch hole.
3x3 T = 3x3 Cast Iron Tee, main to be cut and tee inserted.
* = For street lamp service only.

Fig. I shows a good form of service drip. Use tees with plugs in turning right angles in services, instead of ells.

Curb cocks, if used, should be set uniformly, either at a fixed distance from the building or a fixed distance from the curb. A heavy all-iron stop box with large inside diameter and loose cover without a screw, is preferable to a light, small, iron box or a part-wood one. Curb cocks on services are of doubtful utility in towns and cities similar to those in our three states. This is excepting large services and services in the business section of the town.

Only beaded malleable fittings should be used for service work. Galvanized fittings are better than black, and recessed fittings better than plain. In other words, the best fitting to use for service work is a recessed, galvanized fitting. These, however, cost about twice as much as beaded, black fittings. Galvanized fittings cost about fifty per cent more than black. A recessed fittings is one which is counter-bored, so that when the pipe or nipple is screwed home, the threads are completely covered.

Meter Fitting—The long controversy over lead versus iron meter connections seems to have settled down to a compromise of iron inlets and lead outlets on small meters, and all iron on large meters. The lead outlet gives the required flexibilty to reduce strain on the columns of the small meters.

Fig. III shows an iron inlet connection, and Fig. IV a lead outlet connection. The iron inlet is identical for 3, 5 and 10 light meters, as far as the ell in the outlet of the ¾-inch cock. This style of connection is particularly desirable where no curb cocks are used on the service, as the meter connection can be run as far as the cock when the service is installed and the cock plugged. The connection can then be completed when the meter is set. If a lead inlet is used under the same circumstances, there is a possibility of its being wrenched off and stolen before the meter is set. This applies particularly to new houses. For the above style of meter connection, one threaded and one solder-joint meter union is required for each meter. The meter companies will supply these on order.

The lead outlet connection needs little comment. This form with the union inserted in the end of the lead pipe has so many advantages over the old style with the union inserted in the pipe at right angles to the center line of the pipe, that the latter seems to have no reason for existence.

Fig. V shows an all-iron inlet connection for meters of 20-light and over. Particular attention is called to the full-swing joints which require more fittings, but enables a much more accurate fit to be made to the meter, and also makes a ready alteration possible for meters of different widths. With this style of connection and reasonably careful fitting, there should be no strain whatever on the meter columns.

It is good practice, where a number of meters are required for different consumers in one building, to connect them all to one service. The meters in this case should be

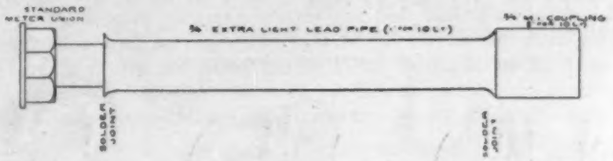


FIG. IV LEAD OUTLET CONNECTION FOR 3, 5 OR 10-LIGHT METERS

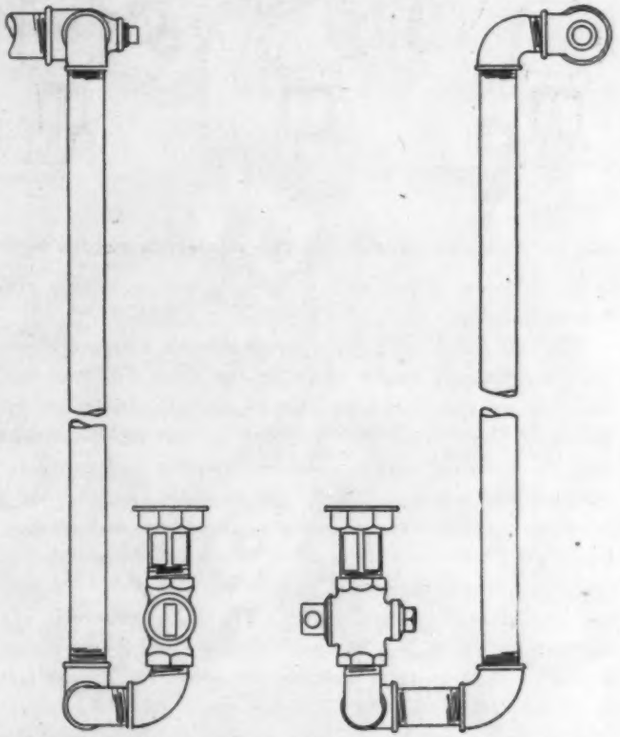


FIG. V. STANDARD INLET CONNECTION FOR METERS, 20 LIGHT OR OVER

kept in an even line and connected to one header run from the service. Fig. VI shows a header so designed that it can be extended.

All meters, whether large or small, should be supported at the bottom, and never hung from the connections. Meters should be set at or within sight of the head of the service.

House Piping—So much work has been done on this branch of the subject that it seems useless to repeat. The rules to follow are extracted from those recently adopted in several cities, which were compiled with slight changes from other standard practice.

The principal criticism will no doubt be upon the large size of piping required. Extensive experience has shown

that this is in no sense excessive.

1. The piping must be tight, under a pressure of 10 inches of mercury column when completed, and after the piping is closed in and before the fixtures are hung.

2. The size of pipe shall not be less than those called for in Table 2.

3. No house riser shall be less than ¾-inch.

4. No house pipe shall be less than ⅜-inch.

5. No branching for stove line shall be smaller than ¾-inch.

6. Gas is never to be supplied from a smaller pipe to a larger one.

7. No pipe smaller than ¾-inch to be used between outlet of meter and outlet of range.

8. Pipe must be free from obstructions.

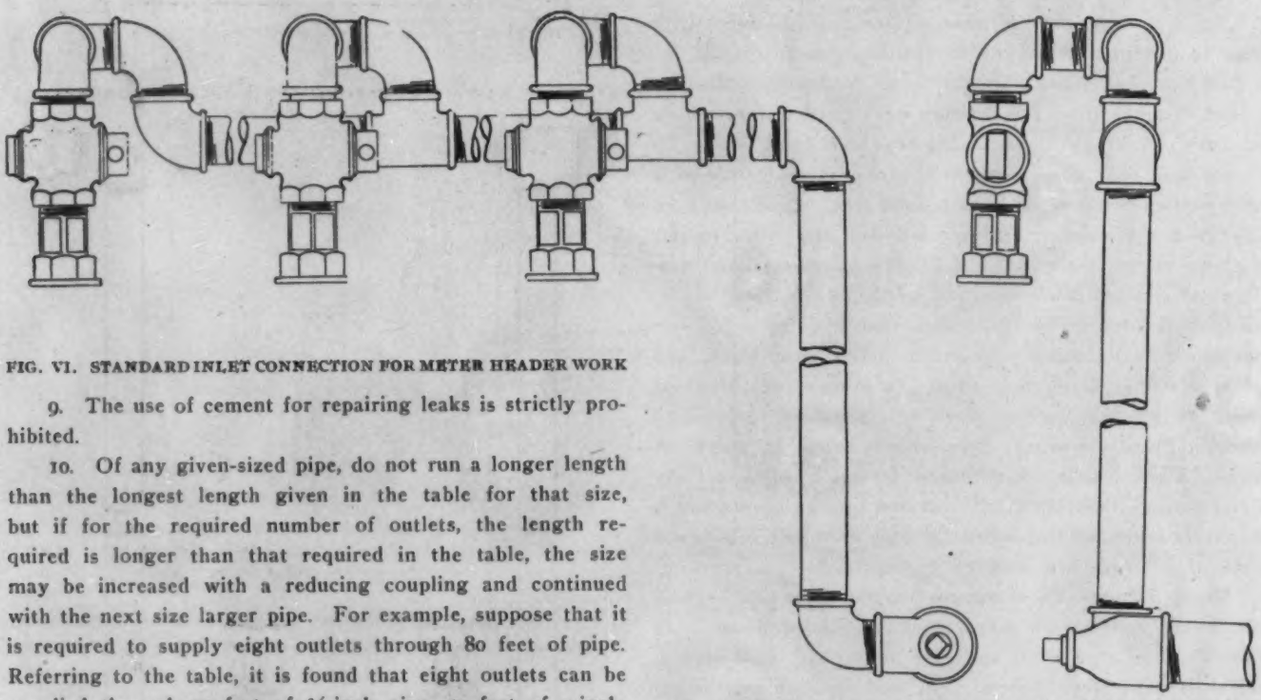


FIG. VI. STANDARD INLET CONNECTION FOR METER HEADER WORK

9. The use of cement for repairing leaks is strictly prohibited.

10. Of any given-sized pipe, do not run a longer length than the longest length given in the table for that size, but if for the required number of outlets, the length required is longer than that required in the table, the size may be increased with a reducing coupling and continued with the next size larger pipe. For example, suppose that it is required to supply eight outlets through 80 feet of pipe. Referring to the table, it is found that eight outlets can be supplied through 13 feet of ¾-inch pipe, 50 feet of 1-inch, 100 feet of 1¼-inch, and so on. The eight outlets in the example can, therefore, be supplied by 80 feet of pipe consisting of 17 feet of 1¼-inch, 50 feet of 1-inch, and 13 feet of ¾-inch, using reducing couplings at the junctions.

11. In figuring out the size of pipe, always start at the outlets or extremities of the system and work toward the meter.

12. White lead or other joining material should be used sparingly so as not to clog the pipe.

13. The riser must be extended to a point within 18 inches of the proposed location of the meter and to right of same.

14. Risers should not be scattered, but should drop together in alignment to the basement.

15. No elbow should be put on the bottom of any riser, but the bottom of all risers should have a tee.

16. In making outlets, always use fittings; do not bend the pipe.

17. Unions should not be used in concealed work.

18. Long runs of horizontal pipe should be firmly supported at short intervals to prevent sagging.

19. All branch outlet pipes should be taken from the sides or tops of running lines, never from below. Bracket lines should be run from below when practicable.

20. House pipes should be so run and covered as to be readily accessible.

21. Risers should be run in partitions in preference to outside walls.

Appliance Fittings.—The connections of appliances present such a great number of variations that it is impossible to go into detail. The bulk of appliances consists of stoves and water heaters, and even in these the variety prohibits standardizing, but does admit of general rules, many of which have been covered under House Piping, and attention is called to Rules 1, 7, 8, 9, 12, 17 and 18, which it is unnecessary to repeat here.

Sixty feet of ¾-in. pipe will deliver about 100 cubic feet of water gas per hour with 0.3-in. drop in pressure, or of about 110 cubic feet of coal gas. As an ordinary double oven range will use 100 cubic feet of gas an hour, all on, nothing under ¾-in. pipe should be considered for connecting gas ranges. Further, when it is considered that water heaters when installed are connected to the stove line, it is a question as to whether 1-in. pipe would not be better, particularly for long runs. It is conceded that a uniform size for all lengths is the most preferable and as the difference in cost between ¾-in. pipe and 1-in. pipe is only a trifle over one cent per foot, there seems to be a fairly good argument for using 1-in. pipe exclusively.

Where it is necessary to drip the gas stove-line away from the meter, it should be equipped with a drip at the lowest point made from a nipple six inches long and provided with a hose cock or other small opening cock, and not with a cap or a plugged coupling. The drip should only be installed in a place readily accessible and protected from freezing.

The question of installing a shut-off cock with each appliance is an open one, also the location of the cock if installed. The one argument in favor of a cock is the means given to control the gas in case of accident to the appliance, or to make repairs. Any cock should therefore be placed at the appliance and not at the meter. As a general proposition, it is good practice to install cocks on

all industrial appliances and omit them on domestic appliances, the argument against their use in the latter case being briefly the additional expense and danger of misuse by the consumer with possibility of exploding the appliance.

Gas stoves with back flue outlets should not be placed closer than eight inches to a wall. In disconnecting stoves, the riser through the floor should be screwed out and the line plugged below. This is to prevent possible injury to occupants by tripping over the pipe.

The appliance next in importance to the gas stove is the water heater. While water heaters are of two classes, circulating and instantaneous, with two types of the latter, the same general rules for connection apply to each.

The connection should be directly from the meter. Circulating heaters can generally be connected to the stove line. If there is none in use, one can be installed for the heater connection and the stove connected later. Instantaneous heaters of the pressure type, such as the Ruud and Monarch, should be connected with the size pipe given by the manufacturers, but never with less than ¾-in. Instantaneous heaters of the open type should have a direct line not less than ¾-in. The connection of any type to an outlet will usually result in trouble. The flue pipe of all heaters should be run to the chimney or out doors. The practice of ending the flue pipe in a disused room, or garret or cellar way, is a poor one and saves very little in the installation. All water pipe and fittings should be galvanized and of the size called for by the manufacturer, but never less than ½-in.

Circulating water heaters occasionally present some difficulties in their installation, and it seems to be quite usual to decline to connect them to horizontal boilers of any type. This is unnecessary loss of business, as a circulating heater can be made to give results with any kind of boiler in any location.

Fig. VII shows a standard connection to a vertical boiler. Fig. VIII shows a standard connection to a horizontal boiler when the heater can be set below the boiler. This requires usually the insertion of the bent hot water tube A. Fig. IX shows a connection to a horizontal boiler when the heater is placed above the boiler. This method is used where the boiler is low and should be used in preference to setting the heater in the cellar or basement, where it would be subject to freezing.

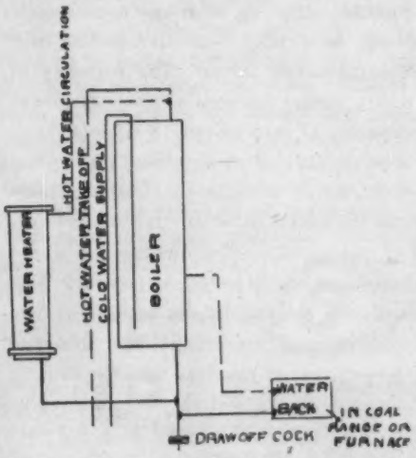


FIG. VII. CONNECTION FOR CIRCULATING WATER HEATER TO VERTICAL BOILER

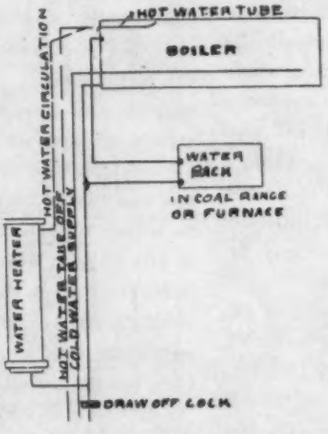


FIG. VIII. CONNECTION FOR CIRCULATING WATER HEATER TO HORIZONTAL BOILER

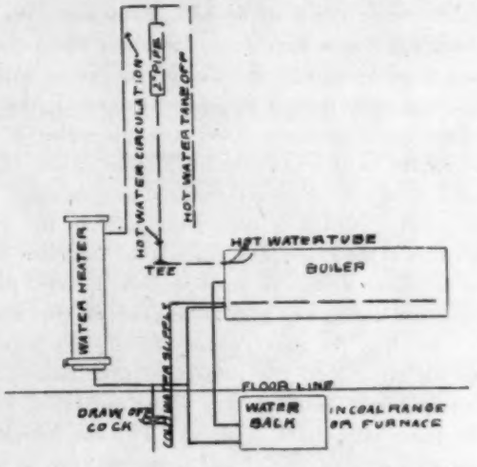


FIG. IX. CONNECTION FOR CIRCULATING WATER HEATER TO HORIZONTAL BOILER WHEN HEATER IS ABOVE BOILER

Table 2—House Piping.

Outlet.	¾-in. Pipe.	1-in. Pipe.	1¼-in. Pipe.	1½-in. Pipe.	2-in. Pipe.	2½ in. Pipe.	3-in. Pipe.
1	20	30	50	70	100	150	200	300	400
2		27	50	70	100	150	200	300	400
3		12	50	70	100	150	200	300	400
4			50	70	100	150	200	300	400
5			33	70	100	150	200	300	400
6			24	70	100	150	200	300	400
8			13	50	100	150	200	300	400
10				35	100	150	200	300	400
13				21	60	150	200	300	400
15				16	45	120	200	300	400
20					27	65	200	300	400
25					17	42	175	300	400
30					12	30	120	300	400
35					1	22	90	270	400
40					1	17	70	210	400
45						13	55	165	400
50						2	45	135	330
65							27	80	200
75							20	60	150
100								33	80
125								22	50
150								15	35
175									28
200									21
225									17
250									14

Gas engines should always be installed by the gas company and not by the agent or salesman. Table 3 gives the size meter and connecting line. A separate meter should be used and an independent line run in all cases. The exhaust should be one size larger than the tap on the engine and should have the minimum number of turns with sweeps instead of elbows for turns. A small gas holder with oil for the liquid and a stop to prevent blowing is preferable to a rubber bag. In small towns where it is not possible to employ an experienced gas engine man, a hot tube is preferable to an electric igniter, but if an electric igniter is used, the negative pole of the battery should be connected to the insulated side of the spark plug and the coil inserted between the positive pole and the ground side of the spark plug. City water with a slight overflow is preferable to tank water. If a circulating tank is used, allow about fifty gallons per hour horsepower and install a float or tell-tale on the tank to be sure that it is full.

Table 3—Size of Meter and Connection for Gas Engine Connection, 150 Feet Long or Less.

Engine Horse Power	Size Meter.	Size of Pipe. Size.	Length.	Size.	Length.
1- 4	5	1	150		
5-	10	1	100	1¼	50
6- 8	20	1¼	150		
9-10	20	1¼	50	1½	100
11-12	30	1¼	150		
13-14	45	1½	100	2	50
15-20	60	1½	50	2	100
21-30	100	2	100	2½	50

Note.—Run no greater length of any size than that shown in the first column of lengths. For example, to connect a 5-horsepower engine with a line 120 feet long, use 20 feet of 1¼-in. pipe and 100 feet of 1-in.

Table 4—Average Capacity of Standard Dry Meters in Cubic Feet per Hour.

Size.	With 0.3-in. loss.	With 0.5-in. loss.
3	40	55
5	50	75
10	80	120
20	115	160
30	175	270
45	215	315
60	330	475
100	385	600
150	...	1,015
200	...	1,380
300	...	1,635

Other industrial appliances are too widely varied in character to admit of detailed discussion. As a rule all of these appliances have been developed along the most scientific lines by skilled manufacturers, and as their installation is comparatively rare in the smaller cities, the writer would advise correspondence direct with the maker of the appliance in regard to size and method of connection. They will also advise the size of meter required and to check this, Table 4 is inserted, which is copied direct from the answer of the trustees of the Practical Class of the American Gas Institute. It is conservative and most makers' meters, particularly 30-light and under, will pass more gas than that shown.

In all of the above, some difficulty has been found in adhering strictly to the subject of installations and avoiding entering into the discussion of the operation, which accounts for some of the lack of detail. The line between the two is not well defined, and it will probably have to be overlooked in many cases in preparing complete and detailed standards.

ELECTRICAL SUGGESTIONS.

In all electric work, conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a ground or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring, special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors, and securing and attaching of fittings, are specially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant-current systems, every reasonable effort should be made to secure distribution centers located in easily-accessible places, at which points the cut-outs and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

The use of wire-ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended, and this method of accessible concealed construction is advised for general use.

Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires.

DAIRY FARMING BY ELECTRICITY IN CALIFORNIA

With the advent of high voltage electric power lines in California, a new impetus has been given to the dairy business in many localities. Where before there were no systems of irrigation and only wheat could be raised, the electric power has made irrigation possible by the installation of pumping plants which result in rich crops of succulent alfalfa. Five or six crops may be grown with an annual yield of from 10 to 15 tons to the acre. This king of forage plants is now recognized as the ideal grass for dairy stock. One acre will support a cow, and she gives from $5 to $7 worth of butter a month. This makes a very satisfactory monthly income for the farmer, paid in cash by the creamery, and the by-products, calves and hogs, pay all the expenses of making and marketing the butter.

For illustration of electric irrigation, the town of Dixon, Solano County, California, may be cited. From the central power station there about fifty miles of suburban lines radiate through the rural districts, furnishing both illuminating current and power to the surrounding farms. The majority of the plants consist of rotary pumps, driven by ten-horsepower motors, and have a capacity of 900 gallons a minute, or a stream as large as a man's body. At a depth of eighty feet an inexhaustible supply of water is obtained. The wells are ten and twelve inches in diameter, in which the water rises to within sixteen feet of the surface. The pumps are placed in pits to be as near the surface of the water as possible. The number of acres watered by a single pump is as high as 120, which keeps the machine running continually, but with the advantage over other power that it requires no attendant to care for it; for after turning on the switch the pump cares for itself. The current is generally purchased at a flat rate of $3 or $4 per month per horsepower.

Among the many advantages of this system of irrigation are that the owner is independent and has absolute control of his water supply; he can use it whenever he wants it without fear of quarrels with his neighbors, who, under other conditions, might want to use it at the same time; he has no fear of drought, and the water is always clean and free from noxious weed seeds.

And the benefits of electric power on the farm do not stop here, for by it nearly all of the drudgery can be ameliorated. The farmer no longer has to rise in the small hours to attend to the monotonous work of milking, for with the modern electric milker three hours' work is done in one. This milking device has passed the experimental stage, and is a practical success in daily use. Not the least of its merits is sanitation, for the milk not only is untouched by the hands, but it does not even come in contact with the air. All other mechanical work, as separating the cream, sawing wood, and other chores is done by the same power.

To the busy housewife this faithful and untiring servant is a special blessing. Wash day no longer has its terrors, for by simply touching a button the machine goes vigorously to work. Ironing is made an easier task on hot days by the electrically heated iron, and the sewing machine sings merrily to the gentle pulsation of the wire. Night no longer brings trouble, for the old kerosene lamp and lantern have been eclipsed by the electric bulb, cheerful and safe both for home, barn, and grounds.

In France is a certain chateau where all domestic work is done by electricity, and tourists consider it worth their while to visit the wonder; yet no less wonderful and far more practical are the electric dairy farms of California.—"Earth."

PACIFIC COAST GAS ASSOCIATION.

To the Members of the

Pacific Coast Gas Association:

Gentlemen:—COME ONE! COME ALL! As the date of our fifteenth convention is drawing near I take this means of notifying you of the following arrangements that have been made in order that you can make your plans accordingly.

Railroad Rates.

The Southern Pacific Railroad Company has named a special rate of full fare and third from all points in California to Santa Cruz and return. Instructions have been issued to their agents to put this rate into effect ten (10) days prior to the meeting, and the same will remain in force forty-eight (48) hours after adjournment of the convention on Thursday, September 19; in other words, up to the Saturday night following the close of the meeting. At the time of purchasing your tickets you should notify the agent that you are to attend the association meeting, and at that time you will be furnished with a receipt certificate, which certificate will have to be countersigned by the secretary of the association or his representative, in order to secure your return ticket from Santa Cruz. You should buy your ticket for one way only, for which you will be required to pay full rate, but your return ticket, after the receipt certificate has been countersigned by the secretary of the association, will be furnished you at one-third of the regular fare. The above arrangement will also apply to tickets purchased at Reno, Nevada, by members of the association, as outlined.

Hotel Accommodations.

The proprietor of the Sea Beach Hotel has named the following special rates for members, their families and friends:

Single rooms.....From $3.50 to $ 6.00 per day
Double rooms.....From 5.00 to 10.00 per day

The above rates are for accommodations on the American plan and include meals.

The general manager of the Santa Cruz Beach Company has made the following special rates, covering accommodations at the Cottage City:

One-room Cottages.

8x10.	For one person, per week	$ 4.50
	Per night	.75
	(These are furnished to care for one person only.)	
10x12.	For one person, per week	5.50
	Per night	1.00
	For two persons, per week	8.00
	Per night	1.50
12x14.	For one person, per week	7.00
	Per night	1.25
	For two persons, per week	10.00
	Per night	1.75
	For four persons, per week	15.00

Two-room Cottages.

10x12.	For two persons, per week	11.00
	Per night	2.00
	For four persons, per week	16.00
	Per night	3.00
12x14.	For two persons, per week	14.00
	Per night	2.50
	For four persons, per week	20.00
	Per night	3.50

Four-room Cottages.

	Four persons, per week	21.00
	Per night	4.00
	Eight persons, per week	30.00
	Per night	6.00

The latter rates do not include meals, but same can be secured at the grill.

Papers.

While I am not prepared at the present writing to advise you of the titles of the various papers to be presented before the convention, still they will be up to the usual standard and no doubt will bring forth discussions of much merit. Suffice it to say that all who attend the coming convention will return to their "camping ground wiser and better men," for all those who visit beautiful Santa Cruz never have an idle moment, and if they do, it's their own fault.

Make your arrangements at once, and give your wife, children and sweethearts something to look forward to by getting in line for the banner meeting of the association.

Yours very truly,

JOHN A. BRITTON,
Secretary.

EXPERIENCE DEPARTMENT.

The old wolf of the Experience Department has limped out upon the trail. Call in the little children, and to appease his voracious omniverousness, cast out for his consumption your stored up experience. There is to be a Zoo of Gas Men by the sea, and the wolf yearns to be glutted for the occasion. He devours anything in the shape of experiences—long or short, serious or humorous, pertinent or impertinent. Remember that much of the success of the Zoo depends upon the obesity of the wolf. Feed him now and feed him well, and he will meet you by the sad sea waves.

R. P. VALENTINE,
Experience Editor.

SAN FRANCISCO WATER SUPPLY

San Francisco.—The matter of an adequate water supply for the city is rapidly becoming the most serious question the new administration has to contend with. The Spring Valley Company appears to be unable to bring in enough water for the needs of the residence district and has lowered the pressure considerably to prevent alleged waste. There is danger of a conflagration should a serious fire start in certain parts of town. The following notice has been issued to water consumers by the water company: "The daily draft on the city distributing reservoirs which supply the high-level districts has become considerably greater than the amount which can be furnished them through our existing conduits and pumps. The company has taken steps to limit the use of water in these districts, which will cause inconvenience from lack of pressure; but this will not be a sufficient remedy, and to preserve fire protection must be supplemented by the united effort of all consumers to reduce the present excessive use of water. A continuance of present conditions will completely empty the city high-level reservoirs within the next two weeks, which would leave a large district absolutely without protection against fire. The company therefore asks for the hearty co-operation of all consumers in its efforts to meet this very serious situation."

CO-OPERATION FOR ELECTRICAL CONTRACTORS.*

By J. Robert Crouse.

In discussing the detailed plans of this Association in those respects in which I believe they have a proper bearing on the contractor's business, I will follow the subjects treated by your very able and worthy President, before the National Electric Light Association last month in Washington. They are, in order:

1. The wiring of buildings, to which I will add new business getting in general.

2. The standardization of work, materials and appliances.

3. Trade relations.

As to the present status and commercial attitude of contractors in general, I quote the following, direct from your President's address, which, I may say, is further supported by articles appearing in your trade journal during the past year:

> "His daily effort (referring to the contractor) is in the line of increasing his business, but I believe that in most cases this effort is misdirected and wasted. I think that the contractor devotes less energy to obtaining new business than to the execution of the business in hand. Contractors, as such, are not advertisers. They rely almost entirely on personal effort for the extension of their business, and, as his personal effort must also supervise the work in hand, it naturally follows that the solicitation of new business goes to the wall, and, as a result, the contractor's business continues without substantial increase from year to year."

With some exceptions I believe that other branches could be substituted in this quotation for "Contractor," and it would have, in considerable degree, comparable application.

The fundamental reason for this general condition, as I see it, is the highly-technical nature of the business itself —it is comparatively young and, to date, necessarily the product of the technician and the engineer, who, for this very reason, are likely to undervalue the importance of the selling and commercial branch.

As proof that the electrical business was not making satisfactory gains, I cite you a second time that the incandescent lamp business gained only five per cent in 1904, over 1903; only eight per cent in 1905, over 1904—a notable decrease from the gains of earlier years, during which the peculiar and exclusive merits of electric service for certain classes of business were sufficient to maintain rapid increase.

At the time mentioned, in 1905, we believed as incandescent lamp makers, and we were further convinced that the electrical trade in general should also be equally interested, that the time had arrived when the old rates of gain in the business would only be secured in future as the result of very materially increased commercial activity all along the line—which is what the Co-operative Association stands for, in a word.

As to this question of wiring, treated of by your President, it is obviously the essential thing for all of us. It directly involves the whole commercial problem, for the public must first be educated to the comforts, conveniences and inherent advantages of electrical service for light, heat and power, before they can be persuaded to invest their good money in the necessary wiring of old or new properties.

Along with this is the equally essential proposition that the central station shall adopt a liberal and progressive policy in the extension of their mains, and that we all lay our work out with due regard to the constantly-increasing efficiency of the service, by reason of which certain classes of business not hitherto considered available will fall within our reach. I have in mind particularly the great developments in new illuminants in the lighting field.

On this great question, of interest to us all, of educating the public to the freest possible use of electrical service, we propose the following plans:

That we get together as manufacturers, jobbers and central stations, and conduct a national campaign of advertising in the magazines and periodicals of the country, and arrange as well for the systematic introduction into the reading columns of timely and interesting articles on electrical development and application.

We propose, also, the establishment of a national electrical press bureau for the systematic dissemination to the daily press of the entire country of news articles on the subject of electrical progress and development, which will have, at the same time, a legitimate commercial value.

Similarly, to have this bureau carry on the same lines of work in the thousand or more trade journals, reaching many lines of retail, wholesale and manufacturing businesses.

As the architect, builder, contractor and real estate dealer are important factors in this question, we propose an aggressive campaign in this direction, namely, the employment of competent representatives whose work would consist of broad and general study of the proposition of the wiring of properties of all kinds, both old and new. The representative would make careful examination into the relations and lack of relations existing between architects, builders, contractors and real estate dealers and the electrical interests. He would make a point of getting in touch with the National, State and City Associations of these lines of the trade, with the hope of presenting before them papers dealing with the subject, and emphasizing the very great present and prospective utility of electrical service for light, heat and power.

This would naturally involve a strong recommendation of the policy of freely specifying extra outlets—floors, baseboards and walls—as well as separate circuits for the heating and miscellaneous electrical appliances, which is not now so generally done as would be in the interests of both the owner or the occupant, and the electrical interests which would directly profit.

Such representative would prepare articles for the trade press of these different trades, which would keep the subject before them in a live and instructive manner. He would tabulate all the effective plans and methods now employed by central stations and contractors, to secure the wiring of old and new properties, and put this into the most useful and convenient shape for general distribution, through their respective trade presses, and the special campaigns of literature which would be issued by the Association direct.

As he would be in touch with the latest practices in wiring and application of electrical devices, he would take charge of and keep the list of applications of electric current up to date, and issue them to the electrical trades and to the allied trades here under discussion.

His work would put him in a position to report to the Press Bureau interesting or novel applications of electrical service, which could be written up and sent to the trade papers, reaching the trades which would be directly interested.

Under the direction of such a representative a campaign of commercial literature, covering this general subject both broadly and in detail, would be issued to a special list of some ten thousand concerns engaged in this business.

The active work of this Association and its representatives should constantly locate the latest and best developments in commercial practice, which, as in the past, can

*Extract from address read before National Electrical Contractors' Association.

be given wide publicity through the technical press. The Association would aim to co-operate with your trade journal in furnishing commercial data of direct and particular interest to the contractor.

The Association has, and will, from time to time, offer prizes to bring out the best productions along special lines of commercial work, which, in turn, will be made of direct value to its members. Twenty-six hundred dollars in prizes is now a standing offer for the preparation of an electrical representatives' hand-book, which is open to all your members.

Division 5 of this proposed hand-book deals directly with the general subject of wiring, and other parts of it deal with the whole question of the sale of electrical service and appliances. The final book adopted will be of undoubted value to your members, and to every one in the business.

The Association would plan, either directly or through co-operating advertising agencies, to provide for the contractor a highly-specialized advertising and follow-up service for issuance locally, suitable to the solicitation of new business, whether for wiring or for the sale of appliances. I take it that such a provision, based upon the best practice of your most successful members, would be of very material advantage, and that there exists among you a real need for vigorous agitation of this method of business development.

Finally, as the personal element is the backbone of any sales scheme, this Association, as the plans are now drawn, will ultimately have a considerable number of representatives in the field, whose business it will be to travel from city to city, for the purpose of stirring up increased commercial interest and activity. Through wide observation of men, methods and policies, they should be able to collect the best commercial practice of both the contractors and the central stations, and, in turn, bring to those visited the advantages and benefits of the best and most successful commercial methods along every line. A logical part of their work would also be to seek to bring about locally closer commercial co-operation, which they would undertake to do, based upon the relations established in cities where the local interests are working together in harmony.

As to the second topic touched upon by your President, before the Washington Convention, namely, standardization of work, materials and appliances, as I see it, the subject lies somewhat outside of the direct scope of the Co-operative Association. Since, however, honest work, good material and efficient appliances are essential to satisfactory and permanent service to the customer, the basis of any substantial commercial progress, whatever the Co-operative Association could do along this line, would be in the direction of accomplishing its objects.

The third topic, trade relations, is an important one, as your President emphasized. I have heard this subject so much discussed from so many angles, that I should not wish, in behalf of and in advance of the formal organization of the Co-operative Association, to express more than my personal views on the subject.

The most essential value of an article arises from two elements: First, the transformation of material from useless to useful forms. Second, from transporting the finished articles from places where they are not wanted to places where they are needed. To the value, as thus represented under our present system of business, valuation is created by the addition of barter or selling cost and profit, which represent the more active competitive elements in trade. Close observers of modern business developments entertain the view that the final test and pressure of real efficiency, like the law of gravity, is constantly exerting an increasing downward pressure upon both of these items. Improved trade relations along practicable lines would, therefore, seem to most logically justify themselves if sales expense could be reduced through the elimination or reduction of duplicated competition for business. Such aggregate saving in sales expense would turn up as an increased profit to the distributor, with the same price to the consumer or a decreased price to the consumer, with the same profit to the distributor, or, what is more likely, a mean between the two.

This, I believe, is the active principle underlying the Co-operative Association, as it likewise underlies the question of internal trade relations.

I should like to advance the proposition that the cultivation of the spirit of business co-operation, at which this Association aims, may reasonably be expected to accomplish progress in these directions. A necessary preliminary to this is that men representative of the various branches of trade shall systematically be brought into personal contact, for the interchange and comparison of views, as will be accomplished in the Directorate of the Co-operative Association.

I believe, as regards the present relations of the central station and the contractor, that their interests in the local development of electrical service must be essentially identical, and that a disposition to co-operate will be bound to bring about, through improved relations, a larger degree of efficiency and success to both. The situation in this respect, I take it, is entirely satisfactory to the contractors, where the central station confines itself to selling the current only. Where they merchandise a practical compromise measure would seem to be the conduct of such selling on the basis of a legitimate profit, so that the contractors and dealers may have equal opportunity to develop both their own and the general business in the various cities. In either case, the active extension of business is doubtless more a matter of aggressive commercialism and salesmanship than of price. So far as the central station is concerned, the merchandising of appliances, etc., is, in any event, a means to their main object, namely, the sale of the largest amount of electrical current at a profit. Therefore, a liberal and progressive policy in such cases, which is already in vogue in some places, would be the application of whatever revenue might be derived through such merchandising to the general advertising of electrical service for the benefit of all the local electrical interests.

Whatever may be the relations or lack of relations between the contractor and the central station, other than the two above cited, it is apparent that a maximum of business will result from their working together as harmoniously as possible, or otherwise the proposition seems to be proved that one or the other of them is not an essential factor in electrical development, which no one at this time would undertake to maintain.

It is to be sincerely desired that improved trade relations can be brought about likewise between the contractors and the jobbers, and I hope the time will soon come when, in the spirit of fair play and co-operation, a determined attempt to effect such relations will be undertaken.

On certain of the plans as above outlined, $55,000 has already been spent, and fully an equal amount by the trade papers and advertising agencies and others whose co-operation has been secured and induced.

During the last ninety days, $90,000 has been underwritten, and for the completed plans, as drawn, an ultimate expenditure of $370,000 is involved.

Indicated by the barometer of incandescent lamp demand, it may be said that this co-operative movement was started May 12th, 1905, when the incandescent lamp manufacturers appropriated the initial $10,000 for its execution. The gain in lamp sales for the country at large was five per cent in 1904, over 1903; eight per cent in 1905, over 1904; twenty per cent in 1906, over 1905, and, so far this year, more than twenty-five per cent over the corresponding period of 1906. There is no reason why equally good results should not be apparent in the other branches of the business.

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EDITORIAL.

APPRECIATION OF PUBLIC UTILITIES.

It is a curious and yet unmistakable phase of the life of any great American city, that there is in the public mind a positive and deep-rooted aversion to the corporations which control great public utilities. This aversion is sometimes founded on good reason, but is more often due to an indefinable mistrust and to thoughtless prejudice. Poor service or excessive tariff provides fair cause for protest or complaint, but not for the popular presumption that any and every public utility corporation is a natural enemy to the community. We too often lose sight of the fact that the fundamental interests of a city and a corporation which operates a public utility in that city are necessarily identical or parallel. The prosperity of a public service corporation obviously must depend upon the prosperity of the community in which it operates.

The first principle of a public service corporation is, of course, to serve the public. Unless it succeeds in doing so by giving a fair measure of satisfaction, it cannot realize a profit on its investment. While the majority of public utilities are natural monopolies, no commmunity will long tolerate a monopoly which provides inferior service.

The general hostility to public service corporations is encouraged by sensational newspapers, because their editors realize that savage assaults upon the managers and the methods of these corporations will strike a responsive chord in the majority of their readers' breasts. "We must roast some one, and it might as well be you" seems to be frequently the tune of such irresponsible journalists. Caustic complaint of the awkward aberrations or stupid negligence of telephone operators is a prolific text for writers and artists in the comic papers, while the woes of the "strap hanger" on a crowded street car provide almost as ludicrous matter as gibes against the irrepressible mother-in-law. Of more serious moment are the intrigues, usually fostered by at least a portion of the press, of jealous rivals and the mischief-making of eternally reckless agitators.

Meanwhile the public service corporations go on from day to day providing us with utilities that we have come to regard not only as essential, but as our birthright. But, supposing for even twenty-four hours every public utility to which a civilized community has grown accustomed was suddenly cut off. Can we picture the chaos and paralysis of every-day life that would follow the sudden interruption of light service, the cutting off of our water supply, the complete cessation of the telephone system, and not a street car running? In some of these matters, indeed, we have suffered sufficiently to realize the intolerable inconvenience and the grievous losses that are involved as soon as one of these public utilities is even temporarily out of joint.

In the bustle of every-day existence we do not pause to consider the vital part that each great public utility plays in our lives, directly and indirectly, and if we did so our distrust and prejudice against these corporations might be tempered by a consideration of their merits. Certainly we should be less prone to regard these essential factors in modern civilization and business as natural enemies, and we should not be so ready to accept with approval the assaults of every reckless demagogue and to hurl our own brickbats of thoughtless criticism the moment we experience an unavoidable accident or temporary inconvenience.

When the history of the last eighteen months in San Francisco is calmly and dispassionately reviewed, it will be found that by far the greatest factor in the reconstruction of San Francisco and the rehabilitation of her business was the speedy restoration of

street-car service after the great fire, and the early resumption of water, telephone and light service. Never in the annals of public utility corporations in this or any other country had companies to face such extraordinary conditions, nor to battle against such monster odds. The managements sacrificed every consideration except that of restoring at once our most necessary conveniences, and it was done in an incredibly short space of time. Indeed, before the bricks were cold in the burned district cars were running, not only providing the people with an incalculable convenience, but presenting the surest sign of restored confidence.

From that day to this, despite innumerable obstructions, the United Railroads, the Pacific States Telephone Co. and the San Francisco Gas and Electric Co. have never wavered in their policy of doing their utmost to provide adequate service and to improve their systems. With these ends in view, the United Railroads has spent over six million dollars in the last eighteen months, and amounts almost as great have been expended by other companies. Moreover, they have waged a valiant battle for the principle of industrial freedom, and once and for all have established the wholesome facts that a great industry can be operated in San Francisco without servile dependence upon a Labor Union, and that the liberty of the individual is still a sacred right in this city, in which there has been such reckless disposition to deny it.

With a record of such achievements, it must be realized that these public service corporations at all events have rendered this city extraordinary public service, all the benefits of which cannot yet be measured. It is still too prevalent a fashion to regard them natural enemies of the people and to consider them a proper target for the assaults of a sensational press. We believe, however, that conservative citizens are not unmindful of such record. In the light of the fact that the United Railroads is such an essential factor in this city's reconstruction, it is obvious that it is the poorest policy to place unnecessarily any obstruction or embarrassment upon that good work. The sole test by which such companies should be measured by the Board of Supervisors or by the people at present is the test of public convenience. When, also, the conditions of the city are once more normal, it will be plenty of time to consider the feasibility of converting the overhead trolley system to an underground conduit, and of getting a water supply from the Sierras. If the people and the Board of Supervisors will divorce themselves from illogical prejudice against public service corporations, and will refuse to go to extreme measures at the instigation of interested individuals, the public convenience will surely be better served.

PERSONAL.

J. R. S. Thompson, of the Pacific Electric & Mfg. Co., is out of town for a week.

F. G. Drum and H. L. Trevis have removed their offices to 704 West Coast Life Building, Pine and Leidesdorff Streets, San Francisco.

Mr. W. W. Briggs, San Francisco, manager of the Westinghouse E. & M. Co., is again back to his desk after ten days of rest and recreation at Tallac.

Mr. H. L. Wrightson, representing the Locke Compressed Air Drill Company, has just completed his trip through Nevada and is stopping at the Fairmont for a few weeks prior to his return East.

Dr. O'Reilly, known among the Christian Brotherhood as Brother Potamian, has recently concluded his fifty-fourth lecture to the annual summer school of instructors in that order, assembled at St. Mary's College, Oakland. Dr. O'Reilly is professor of physics at Manhattan College, New York, and is an eminent scientist and author of recognized standing. He is an intimate associate of Lord Kelvin, with whom he is in constant communication, interchanging views and observations on their various works and discoveries in the electrical field.

TRADE CATALOGUES.

"Electrical Measuring Instruments" are illustrated and described in a handsome catalogue from the Jewell Electrical Instrument Co., Chicago, Ill. Their apparatus includes direct and alternating current meters for portable, laboratory and switchboard uses.

Revised bulletin No. 1412 from Allis-Chalmers Co., Milwaukee, Wis., illustrates and describes Crushing Rolls. This, we believe, will be found of greater value to users of such apparatus than any publication heretofore issued, as it contains very complete tables of dimensions and lists of parts.

The Welsbach Company, Gloucester, N. J., sends ten interesting bulletins neatly bound in flexible leather holder, entitled "Incandescent Gas Lighting." The bulletins are well printed and illustrated, and contain valuable information on the incandescent gas lighting industry, many being reprints of papers read before the various illuminating engineering associations.

TRADE NOTE

The Standard Underground Cable Co., A. B. Saurman, Pacific Coast manager, are now permanently located in suite 511, 512, 513 and 514 Shreve Building, San Francisco. The new factory in Oakland is four times as large as the old factory destroyed by fire last year. It is as nearly fire proof as possible. New, up-to-date machinery for the manufacture of their products has been put in, so that they are equipped to turn out on short notice insulated wires and cable for any service. This is the only factory of its kind west of the Rocky Mountains.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	AUGUST 16		AUGUST 17		AUGUST 19		AUGUST 20		AUGUST 21		AUGUST 22	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	78	80	78	80	78	80	78	80	78	80	78	80
2,250,000	M & S	Bay Counties Power Co. 5%	94¾	.....	95	.....	95	95½	95	95¼	95	.....	95	.....
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	79	79½	79	80	79	80	.....	80	.....	79½	.....	79½
900,000	J & J	California St. Cable Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
2,000,000	J & J	Contra Costa Water Co. 5%	.....	100¼	.....	100¼	.....	100¼	.....	100½	.....	100¼	.....	100½
1,000,000	J & J	do do Gen. Mtg. 5%	.....	97½	.....	97½	.....	97½	.....	96	.....	96	.....	96
623,000	F M A N	Edison Light & Power 6%	105	.....	.....	112	106	112	106½	.....	108	112	108½	112
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	.....	108½	.....	108¼	.....	108½	.....	108½	.....	108½	.....	108½
671,000	A & O	Geary St. Ry. 5%	52	.....	52	.....	52	.....	52	.....	52	.....	52	.....
610,000	M & N	Honolulu R. T. & L. Co. 6%	105½	.....	105½	.....	105½	.....	105½	.....	105½	.....	105½	.....
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
500,000	J & J	Los Angeles Elec. Co 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
5,000,000	A & O	Los Angeles Ry. 5%	107½	111½	108	111½	108	111½	108¼	111½	108½	110½	.....	110½
1,000,000	A & O	Los Angele Lighting Gd. 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	103
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	102¾	.....	102¾	.....	.....	104	.....	.....	.....	.....	102⅞	.....
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	101	.....	101	.....	101	.....	101	.....	101	.....	101
3,000,000	J & J	Market Street Cab'e 6%	.....	110	.....	110	.....	108½	.....	108	.....	108	.....	108
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	.....	104	.....	105	.....	105	.....	105	102¼	104	102½	104
100,000	A & O	Mill Valley & Mt Tamalpais S.Ry.5%	103	.....	103	.....	103	.....	103	.....	103	.....	103	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	113	.....	113	.....	113	.....	113	.....	113	.....	113	.....
1,498,000	J & J	North Pacific Coast R. R. 5%	101	102	100¾	101¼	100¾	101½	101	.....	101	.....	101	.....
1,074,000	J & D	Northern Cal. Railway 5%	105	.....	105	.....	105	.....	105	.....	105	.....	105	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	100	.....	100	93	97	93	97	.....	97½	.....	97
6,000,000	A & O	Northern Electric Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½
1,000,000	M & S	Oakland Gas Light and H. 5%	104	.....	104	.....	104	.....	.....	106	.....	106	.....	106
1,374,000	J & J	Oakland Transit Co. 6%	110	.....	110	.....	110	.....	109½	.....	109½	.....	109½	.....
1,600,000	J & J	Oakland Transit 5%	104¾	.....	104¾	.....	104¾	.....	104¾	.....	104	.....	104	.....
1,326,000	J & J	Oakland Transit Con. 5%	102	103	102	103	102	103	102	103	.....	103	.....	103
7,000,000	J & J	Oakland Traction Con. 5%	98½	99¼	98¾	99¼	99	99½	99	99½	.....	99½	.....	99½
1,500,000	J & J	Oakland Water Co. gtd. 5%	.....	99½	.....	99½	.....	99½	.....	99½	.....	99½	.....	99½
2,000,000	A & O	Omnibus Cable Ry. 6%	.....	112½	.....	112½	.....	112½	.....	112	.....	112	.....	112
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½
8,494,000	J & J	Pacific Electric Ry. Co. 5%	.....	104	.....	104	.....	104	103½	.....	103½	104	103¾	.....
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	98	.....	98	.....	98	.....	98	.....	98	.....	98
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	103
350,000	J & J	Park & Cliff House Ry. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
250,000	J & J	Park & Ocean R. R. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
700,000	M & S	Powell Street Railway 6%	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	.....	101	100	101½	.....	101¼	100	101¼	100	.....	.....	101¼
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	112	113	112	113	.....	113	.....	113	112¼	113	112¼	113
3,000,000	J & J	S. F., Oak. & San Jose Ry. 5%	.....	105	.....	105	103¾	.....	103⅞	.....	103⅞	.....	103⅞	.....
1,500,000	J & J	do do 2d Mtg. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
642,000	A & O	Sierra Ry. of Cal. 6%	104¾	.....	104¾	.....	104¾	.....	104¾	.....	104¾	.....	104¾	.....
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	.....	.....	.....	.....	101	.....	101	101¼	101	101¼	101	101¼
4,000,000	J & J	do do do (1910)	101¾	.....	101¾	.....	101¾	.....	101¾	.....	101¾	102	101¾	.....
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	108	.....	108	.....	108	.....	108	.....	108	.....	108	.....
4,127,300	M & N	S. P. R. R. of Cal., 1st c. gtd. 5%	114	.....	114	.....	114	.....	114	.....	114	.....	114	.....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	123	125½	123	125½	124	125½	124	125½	.....	125½	124	125½
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	90	91	90¾	91½	90¾	91½	90¾	91½	89½	.....	89½	.....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	84¼	.....	84½	89	84	.....	84	.....	84	.....	85	87
300,000	M & S	Stockton Gas & Elec. Co. 6%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
20,000,000	A & O	United R. R. of S. F. 4%	70¼	71	70¼	71	70¼	.....	70½	.....	70½	71	70¼	70⅝
2,500,000	M & N	Valleys Counties Power Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
		Water Stocks.												
.....	.....	Contra Costa	.....	62	.....	62	.....	62	.....	62	.....	62	.....	62
6,000	Quarterly	Marin County	.....	62	.....	62	.....	62	.....	60	.....	60	.....	60
280,000	.....	Spring Valley Water Co	22	22¼	24⅛	24¾	.....	24¾	21⅞	22⅜	21⅜	22	21⅛	21⅜
		Gas and Electric Stocks.												
37,500	.....	Martel Power Co	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	.....	Mutual Electric Light Co. (Ctfs.)	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....
37,336	.....	do (Extended Ctfs.)	12¾	.....	12¾	.....	12¾	.....	12¾	.....	12¾	.....	12¾	.....
40,000	Monthly	Pacific Lighting Co	.....	67½	.....	67½	.....	67½	62½	.....	65	67½	65	.....
12,000	.....	Stockton Gas & Elec. Co	52	.....	52	.....	52	.....	52	.....	52	.....	52	.....
		Street Railroad Stocks.												
10,000	.....	California	.....	140	.....	140	.....	140	.....	140	.....	140	.....	140
10,000	.....	Geary	.....	41	.....	41	.....	30	.....	30	.....	30	.....	30
10,000	.....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25	.....	25
	Semi-an.	Associated Oil Co	30	31	30	31	30¼	.....	29½	.....	29⅞	30	29⅞	30
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry	.....	110	.....	110	.....	110	.....	110	.....	110	.....	110
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	.....	90	.....	90	.....	90	.....	90	.....	95	.....	85
180,000	.....	Pac. Tel. & Tel. Co. (Common)	10	.....	10	.....	10	15	10	15	10½	15	10⅛	15

Unlisted Securities

750,000	A & O	Bay Counties Power Co. 6%	.....	100	.....	100	95	.....	97	.....	97	.....	97	.....
745,000	M & S	Blue Lakes Water Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000,000	A & O	California Northwestern Ry. 5%	.....	108	.....	108	.....	108	.....	108	.....	108	.....	108
160,000	J A J O	Marin County Water 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
600,000	J & J	Risdon Iron Works 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
500,000	M & S	S. F. Dry Dock 5%	.....	109	.....	109	.....	109	.....	109	.....	109	.....	109
8,000,000	M & N	S. F. Gas & Electric 4½%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
3,926,000	J & J	S. F. & North Pacific Ry. 5%	104	106	104	106	104	104½	104	.....	104	.....	104	.....
5,500,000	J & J	South Pacific Coast Ry. 4%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
.....	.....	Standard Electric Co. 5%	.....	82	.....	82	.....	82	.....	80	.....	80	.....	80
.....	.....	do do Gtd. 5%	.....	85	.....	85	.....	85	.....	85	.....	85	.....	85
750,000	J & J	Sunset Tel. & Tel. Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½
1,000,000	M & N	Sutter Street Railway 5%	.....	105	.....	105	.....	105	.....	103	.....	104	.....	104
		Stocks.												
50,000	Monthly	Gas Consumers' Association	.....	20	.....	20	.....	20	.....	20	.....	20	.....	20
100,000	Monthly	Northern Cal. Power Co	24	25	24	25	24	25	24	25	24¼	25	24¼	25
.....	.....	Pac. Gas & Elec. (Pfd.)	40	46	42½	.....	40	.....	42½	.....	42½	.....	42½	.....
.....	.....	Santa Cruz Port. Cement	.....	55	.....	50	.....	50	.....	50	.....	50	.....	50
.....	.....	Standard Port. Cement (New)	.....	55	.....	55	.....	55	.....	55	.....	55	.....	55
50,000	Monthly	Truckee Electric Co	14½	.....	14½	.....	.....	15¼	.....	15¼	14¾	15½	14½	15

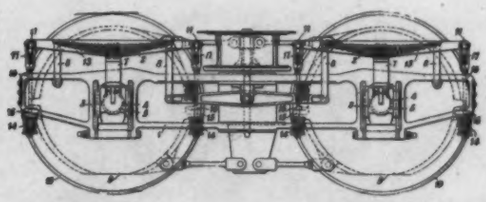
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

SUSPENSION MEANS FOR ELECTRIC MOTORS. 862,198. Charles A. Psilander, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.

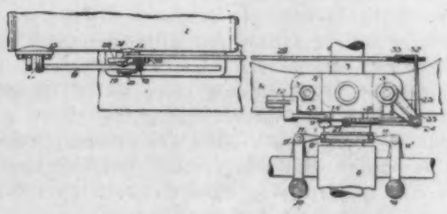
The combination with an axle, bearings thereon, boxes or housings for the bearings, a truck frame, and means



for resiliently supporting the same, comprising leaf springs mounted upon the boxes or housings, of a motor, and means for resiliently supporting the same, comprising a frame having members composed of side-by-side parts that are mounted upon the bearing boxes or housings and between which the leaf springs are located.

GAS ENGINE. 862,568. Charles I. Longenecker, Milwaukee, Wis., assignor to International Harvester Company.

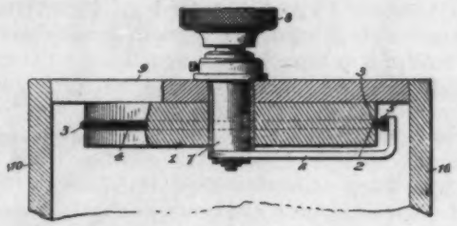
A gas engine having, in combination, speed-governing mechanism, igniter mechanism, a reciprocating rod adapted to make and break contact with a part of igniter mechanism, means for controlling the path of movement of rod



whereby the duration of the make and break contact is regulated, a yielding resistance opposing the action of speed-governing mechanism, and means for regulating the force of resistance, said means being connected with rod controlling means whereby both of regulating means may be operated in unison.

RHEOSTAT. 862,842. Edwin F. Northrup, Philadelphia, Pa., assignor to The Leeds & Northrup Company, Philadelphia, Pa.

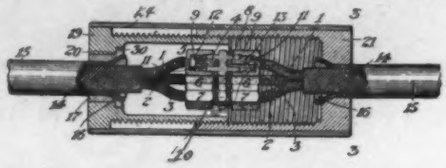
A rheostat, comprising an insulated electrical conductor spirally wound and forming a hollow, coreless tube, the tube



having an exterior lengthwise portion bare of insulation, a support having a recess in which tube is laid sidewise, and a compound forming a binding agent between adjacent convolutions of spiral and between tube and support, the tube being supported wholly from the outside.

COUPLINGS FOR LEAD-COVERED ELECTRIC CABLES. 862,618. John J. Dossert, New York, N. Y., assignor to Dossert & Company.

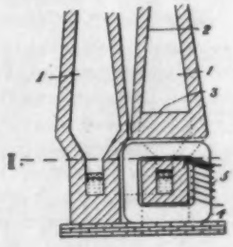
A mechanical connection for electric cables having sheathing spread at their adjacent ends, comprising a coupling applied to cable, coupling having compressible rings



within the spread ends of the sheathing, inter-engaging coupling sections, compressible rings being independent of the coupling sections and means movable relative to rings whereby the ends of the sheathing may impinge against rings.

ELECTRICALLY-HEATED SHAFT-FURNACE. 862,146. Johannes S. Edstrom, Vesteras, Sweden.

In an electric furnace the combination of a shaft, a hearth forming an annular horizontal chamber of substantially uniform cross-section and placed directly beneath the



shaft, a hollow core of fireproof material in the hearth, an iron core in the first-mentioned core, and a primary winding on the iron core.

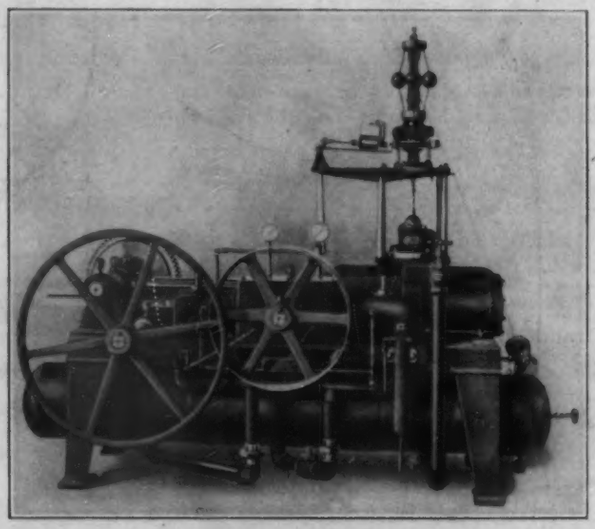
INDUSTRIAL

LOMBARD TYPES O AND P GOVERNORS.

As regards speed regulation, all water-power installations may be divided into three groups, as follows:

1st. Power stations supplying electric current for railways alone or with lighting; those carrying motor loads with or without lighting; and those driving certain kinds of mills where considerable load variations must be taken care of without permitting noticeable speed variations.

2nd. Electric lighting plants carrying insignificant motor loads; large and small manufacturing establishments using nearly constant power; certain small electric power stations where slight variations in voltage or frequency are not especially objectionable; temporary installations for construction or other purposes; water-power auxiliaries run in conjunction with steam-power.



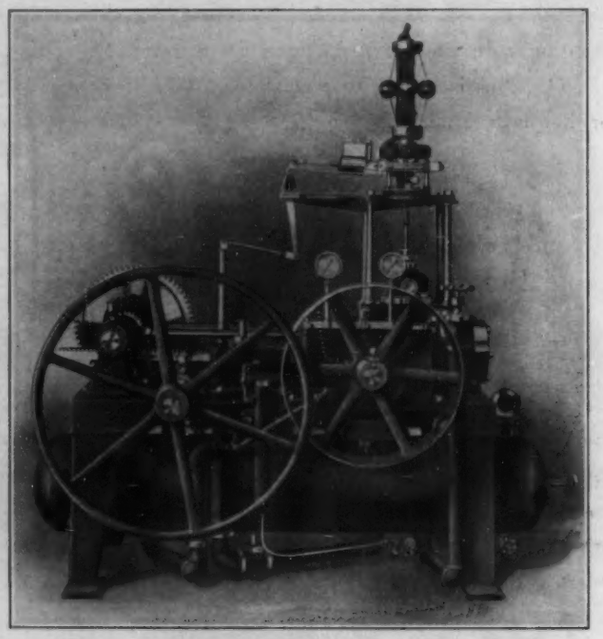
TYPE O GOVERNOR

3rd. Turbine installations for a few kinds of manufacturing where regular speed is of little or no importance; e. g., grinding or hoisting; water-power auxiliaries used occasionally to augment steam-power; small water motors.

Hitherto most of the governors built by The Lombard Governor Co. have been designed and used to regulate water-power developments of the first group. For lack of any other suitable apparatus, these governors of the highest grade have often been used in installations of the second group. Now, however, this company offers two classes of hydraulic governors designed for the first and second groups respectively. In consequence, it is no longer necessary for certain purchasers to buy a better grade of regulator than their work requires, in order to obtain this quality of governor and guarantee. The new governors to be described are much better machines at one-half the cost, than the earlier Lombard governors, many of which are still in use.

Types O and P governors are similar in general appearance and construction to the B and D machines. Fig. 1 illustrates Type P. All of these styles of governors are finished with the same extreme care, and nothing except the best material is used. A considerable saving in the cost of manufacture of the Types O and P governors is due to the elimination of the relaying mechanism of the B and D machines. As a consequence the O and P governors are somewhat slower in action, but simpler in mechanism. For work requiring the promptest gate motion possible, B and D governors are strongly recommended.

This hydraulic governor, whenever it acts, exerts energy which has previously been stored in the form of compressed air; thus no extra load is thrown on the turbine when its gates are to be moved. Consequently, even at light load, the work done by the governor cannot disturb the speed of the wheel. It will retain ample energy in the pressure tank to start a water-wheel at any time, even after standing for weeks. The only manual effort needed is to open a small valve such as a child can handle. When the speed is steady, the governors hold the gates locked in position, whether they tend to close or not. This action consumes absolutely no power. It can not possibly travel farther than the full regular stroke of the piston. They may be adjusted to move the gates within any desirable time interval without throwing any extra load on driving belts. They are invariably quicker acting than the best mechanical governors. Other things equal, the quicker a governor acts the better the speed regulation. All governors are guaranteed without qualification to give better regulation than any others.



TRANSMISSION MECHANISM TYPE P GOVERNOR

Types O and P governors are horizontal self-contained machines, capable of developing respectively, in the act of opening or closing the water-wheel gates, 16,000 and 6,700 foot pounds of energy. All parts are carefully designed to produce this output with a large factor of safety, and these governors may be depended upon to work up to their full rating quietly and without abnormal strain or wear for many years. Some of the earlier machines of somewhat similar design are giving excellent regulation today, after ten years of hard service. On account of their compactness and because they are almost completely assembled when shipped, Types O and P governors are especially adapted for installation in remote regions, or foreign countries, or where skilled labor is not easily obtained. Each machine when sent from the factory is provided with a book of instructions, all necessary wrenches, suitable pulleys and a full charge of oil.

All parts are interchangeable and a careful record is kept so that renewals may be obtained quickly. The cost of maintenance of these governors is low because the principal wearing parts are hardened steel and easily and cheaply replaceable. The value of any governor should be measured by the character of service which it can be depended upon to give. When tested in this manner these machines form, with the other governors, a class of their own.

GOLDEN ANNIVERSARY.

The "Journal of Electricity, Power and Gas" has received an invitation to the Golden Anniversary celebration of the H. Mueller Mfg. Co. This is so unique in its wording that we think it will be of interest to our readers, in full:

"The Technical Publishing Co.,

"Atlas Building, San Francisco, California.

"Gentlemen:

"On September 7th we will celebrate the Golden Anniversary of the founding of our business, by holding a picnic at Chautauqua Park, Mechanicsburg, Ill.

"The members of our Company have requested the writer to invite a member of your staff to be present, which commission he takes great pleasure in discharging herewith.

"In order that he may be relieved of the fatigue of travel, and more thoroughly enjoy the day with us, we suggest that he come to Decatur in the afternoon or evening of the previous day. Accommodations will be provided for him at the St. Nicholas Hotel, and reservation will be made for him in special car which will take the members of the Company and guests to the pleasure grounds at 9 o'clock on the morning of the picnic.

"If convenient, we would be pleased to have you advise the writer whether we may have the honor of entertaining him, so that arrangements may be made for receiving him at the railway station.

"Hoping that the pleasure may be ours, we are,

"Sincerely yours,

"H. MUELLER MFG. CO.

By C. Cox.

NATIONAL ASSOCIATION OF STATIONARY ENGINEERS CELEBRATE THE CENTENNIAL OF FULTON'S FIRST STEAMBOAT.

A hundred and thirty engineers of the Robert Fulton Association of the National Association of Stationary Engineers, sat down to a banquet on the evening of August 11th, at King's Restaurant, Chicago. The occasion for the banquet and attendant speeches was the centennial of Robert Fulton's successful run of the first steamboat a hundred years ago, August 11th, 1807, when the diminutive craft, "Clermont," paddled down the Hudson River.

Speakers of the evening dwelt upon Fulton's work, hailing his gift to the world as one of the greatest in history. Mr. Royal D. Tomlinson, ex-president of the National Association, and supervising operating engineer, and condenser expert for Allis-Chalmers Company, responded to the toast, "Engineers Then and Now." John W. Lane, editor of the "National Engineer," spoke on "Robert Fulton." George N. Carmen, director of the Lewis Institute, responded to "One Hundred Years of Steam," and Chas. W. Naylor, chief engineer for Marshall Field & Co., had for his subject, "A Look Into the Future."

SEPARATION OF STORAGE BATTERY PLATES.

To all who have had occasion to use storage batteries, the question of separating the plates is a most serious one. Different kinds of wood treated with different kinds of acid have been employed; different kinds of rubber, perforated, bent, ribbed, single and double, have been employed with and without additional wood separators; glass rods and wood rods have been employed alone and in combination with some of the above methods, in order to satisfactorily solve the question of the separation between plates.

When small amounts of current are required, as in operating police, fire alarm, railway signals, telegraph and private telephone exchanges and the like, this problem has been very cleverly solved in the novel design gotten up recently by the Gould Storage Battery Co., New York City, and termed the Gould Tandem Couple Type Cell. The question of what kind of separator to use is now unnecessary, as in the new design no separation is needed whatever.

The essential characteristic of this cell is that the plates are set end to end in each cell, one positive plate and one negative plate only, in each glass jar. This differs from the old method of placing plates side by side in the jar or tank where the charging and discharging took place from one side of each plate only; which produced a tendency toward buckling and caused the wear and tear to take place on one side only.

With the plates placed end to end, the discharge takes place from both sides of the plate and from practically all parts of the plates at once, as the current rate is very low for this class of work. This construction eliminates the chance of grounding or short circuit between plates for which there is more or less chance when plates are placed side by side.

A striking advantage of this new design, and one which will appeal to the operating man as a distinct time saver, is that the removal of any couple for inspection, cleaning or renewal, is not attended by the old-time unbolting of connections, sawing of lead, the accompanying lead-burning outfit, etc. The positive plate of one cell is lead-burned to the negative of the next cell, no bolted connections being used whatever, except at the end of the rows. This insures perfect contact between all the cells, and eliminates all chances of the circuits being interrupted on account of poor connections—a point of considerable importance, especially in fire-alarm work.

This method of grouping at the same time greatly facilitates the replacing of any couple with the minimum possible interruption to the circuit, the changing of all groups in the set being a matter of only a few minutes, as there are practically no connections to unbolt and positively no separators to remove and replace. This method of grouping is a money saver on first cost, as well as on maintenance, because it has done away with the use of separators for this class of work, thus cheapening and simplifying the construction of the battery.

In the suit of the Westinghouse Electric & Manufacturing Company vs. Wagner Electric Manufacturing Company, of St. Louis, Mo., on Westinghouse oil-cooled transformer patent No. 366,362, the master has awarded damages to the Westinghouse Company amounting to $132,433.35.

ELECTRICAL MEN HOLD KANGAROO COURT.

Altmann's Cafe, at 32 Second Street, is the present rendezvous of quite a number of the electrical fraternity from the various companies in that vicinity, who gather daily for luncheon. Good fellowship prevails during this period of truce. The dice box invariably is called for with the cafe noir to determine between the parties engaging which shall have the pleasure of paying for the other's lunch. The "peek-a-boo" game seems to be the most popular and always absorbs the animated interest of the onlookers. During one of the recent games between Howard G. Alysworth, the genial supply dealer, and Louis A. Sommers, one of the worthy representatives of the Westinghouse Company, a technical point was raised and finally submitted to a "Kangaroo Court" last Friday for decision. Wm. A. Hall, Roebling's popular salesman, was selected to act as judge, ably "assisted" and reinforced by Patent Attorney Frank Medina, who applied the law to the facts as Judge Hall found them. Chester Pennoyer appeared as counsel for the plaintiff Alysworth, and Tom Collins, also of the Westinghouse, appeared in a like capacity for his colleague, the defendant Sommers. Promptly at 12.30 o'clock Clerk Geo. Lowe rapped for order, and Attorney Collins (no relation to George) opened the case by demurring to the plaintiff's complaint on the following grounds: First, that the plaintiff Alysworth had no legal capacity to sue, and as no guardian had been appointed or had appeared for him the court could have no jurisdiction over him. Second, that the complaint was ambiguous, uncertain and unintelligible.

Judge Medina temporarily overruled the objections, but agreed to listen to argument on the same at the conclusion of the case.

Mr. Alysworth then testified that he had engaged in a wager with the defendant, the stakes being the payment of the following day's lunches. Mr. Alysworth, winning the game but being unable to take lunch the following day at the accustomed place, had on the next meeting requested the defendant Sommers to "come through" with a receipted check or reimburse him to the equivalent in coin of the realm. Both being refused, he therefore sued and asked judgment.

On cross-examination by Attorney Collins, Mr. Alysworth admitted that he did not remember points of the dice as thrown. He also admitted that the time set for delivery of the stakes was specific and determined to be the following day. When asked if he had not usually dined at the expense of those who wagered with him, he indignantly denied that he always won, but on the contrary had frequently lost. He hotly resented the insinuation that he carried "loaded dice." Judge Medina temporarily laid aside the judicial "coonskin" and testified favorably to Mr. Alysworth's reputation for truth and veracity. At the same moment Judge Hall impliedly showed his confidence in the defendant Sommers by engaging in a dice game with him and probably obligated himself by winning the same. When the attribute dignity returned through the open window whither it had been unceremoniously chucked into the "damnedest, finest ruins," their honors then listened to the defendant Sommers who stated that he had agreed in the event of losing that he would purchase the lunches on the day following only, owing to the plaintiff's seemingly increasing appetite, as it had been his misfortune to lose to Alysworth for several days previous.

On cross-examination Sommers admitted that no reference was made in the agreement as to what particular cafe the lunches were to be taken. Mine Host Altmann weakly supported Mr. Sommers in recollecting that the menu had been awaiting Mr. Alysworth's pleasure and that Mr. Sommers had ordered a "special" for his enforced guest. On cross-examination, Altmann was troubled with failing memory and Judge Hall appointed Carl Heise as an elisor to take charge of him pending an investigation of his testimony by a grand jury to be impaneled. It is generally believed that Attorney Collins had framed up a defense for Mr. Sommers with Altmann's assistance. No doubt Collins will be given an "immunity pill" and "Mine Host" will be given a fine far in excess of Standard Oil.

The parties litigant then argued their respective claims. Plaintiff Alysworth said in part: "If the Court please, we submit that it is quite evident which way this Court should and will decide this case. [Judge Hall fines him two Kaiserblumes for his presumption.] The defendant has tried to force me to prove the exact points that the dice showed, yet at the same time he admits that I won and invited me to settle this dispute by taking lunch with him at the "Sign of the Big Steam" with his attorney, where a lunch for three, including refreshments, costs as much as a quarter. Instead of settling this gambling debt as would his liege lord, His Brittanic Majesty, like a gentleman, he endeavors to evade the same, and like a 'piker' seeks refuge behind a technicality. I love money, gentlemen; I adore it for the pleasure it can buy, but I do not love it because it is 'blonde' in color nor because it has a woman's pretty figure imprinted. I can not say as much for the defendant and his attorney. I can bring witnesses to prove that recently the defendant Sommers was given a Hammam bath by a syndicate, and after forty-five minutes of sweating the party extracted from him bullion to the value of $417.90.

"His attorney Collins has not a speaking acquaintance with Truth's black cat. He was elected on one occasion as president of the Amalgamated Liars' Association. He would trim the feathers from a Berkeley mosquito to fill his nest. He assumes the unsophisticated role of an 'Honest John' and gently lures his victims to ruin. After his many years of 'practice at various bars' he hoodwinked the courts of this State into granting him a license to practice at their bar. I am sorry to say that he has now chiseled into the electrical fraternity and each step marks the 'knock' on the brow of a worthy man, yet the Frankenstein he has created will some day devour him. [The last syllable of the name of this new apparatus reminded Judge Hall that a fine was about due; accordingly a "stein of light" was ordered.] In conclusion, gentlemen, I ask that justice be done though the heavens fall. Show to the world that there are some in San Francisco who are like Caesar's wife, and your fame will spread abroad over this land of liberty and even across the great waters to the effete monarchies of Europe, and all up and down the earth like the exhalations of the upas tree or a Chinese umbrella or a Chicago girl's feet or a church scandal, until it has at last reached Oakland."

Attorney Collins for the defense pulled together his seven feet (including the one turned up at the bottom) and addressing Judge Hall as the "learned Dogberry" began his defense. Judge Hall, seemingly honored, smiled at this reference, but Judge Medina came to his rescue and fined the barrister "two Kaiserblumes" for his impudence. The judicial anger being cooled, Collins proceeded: "If the Court please, in support of our demurrer we maintain that the plaintiff is mentally incompetent and has no legal right to sue by reason of his chronic indulgence in 'green paint' and other Parisian concoctions, together with the fact that he is a constant student of the 'personal columns' of the daily press has resulted in a dusty and poor commutating brain. That by reason of a sudden paroxysm of sneezing the remaining gray matter of his brain was forced into the roots of his hair, while the dust, though slightly disturbed, still remains. Bereft of all deep reasoning power, he could but imitate and has been further guilty of posing before every large plate-glass window on the highways and inviting attention to his resemblance to Lewis Morrison.

"We submit, from the facts shown by the testimony, the plaintiff has not proven his case inasmuch as he can not state the points turned on the dice. The mere affirmation of a fact does not constitute a fact. If I were to affirm by chance that your honor is now sober, this in itself would not establish the fact that you are. Your favorable decision can only prove

this fact. [Judge Hall establishes the presumption that a man is still sober when he can hold another at the expense of the defense.] We accuse this 'toupeed' plaintiff of committing champetry and barratry, which are heinous offenses, by encouraging strife, quarrels, litigation, and promoting gambling.

"It is notorious that Alysworth has been feeding off the members of this club for so long a time that the memory of man runneth not to the contrary. And now he equals the meanest man in town who refuses the proferred drink and requests the money in lieu thereof. Mr. Alysworth rolls his goo-goo eyes and says, 'I am holier than thou.' Your honor, I have seen many members of the electrical fraternity and the only good ones have joined the Cemetery Branch. Mr. Alysworth claims he has frequently purchased the lunches of his opponents, but the waiter here remembers full well that he called for the stomach pump when they won.

"The complainant has been for long periods subsisting off of his victims whom he wiles into playing nefarious games for food, drink and raiment, well knowing that the said victims have as much chance of winning as the proverbial snowball in (—) has of preserving its integrity of character in the torrid temperatures which prevail in that infernal place, to which we devoutly hope the complainant may be consigned forever and ever, amen.

"It might be supposed that the complainant, with his hoary head crowned with the frosts of many winters, would be a shining light to the youth of the business world in which he is unfortunately allowed to mingle, unfortunately, that is, for his innocent victims, among which may be numbered the speaker, your honor. Instead of being a beacon of rectitude to the unwary youth such as my client and others of immature years and experience, he proves to be a pitfall of destruction and leads these young men into the dreadful sin of gambling, which, like the opium habit to which we suspect the complainant is addicted, for we can find no other good reason for his practices other than the fact that he must be a dope fiend, leads his victims on so that they lose all respect for themselves, their friends, relatives, God and man.

"Notwithstanding the fact that my client paid this notorious criminal sixty-five cents on the Friday in question, in addition to having been stuck for the lunches for the said day and the day following, this piker now insists on extracting in coin of the realm fifty cents legal tender, to which as all men must perceive he has no legal right whatsoever.

"He accuses me of being a falsifier and states that I was once elected president of the Amalgamated Association of Liars. Your honor, this accusation is most cruel and unjust. I was not elected, I was defeated.

"Your honor, I am not on trial, so therefore do not be misled by his attacks on me. In justice to myself, however, I deny the accusation that my usual dining place is at the 'Sign of the Steam.' I wish it understood that I am not that kind of lady, besides it always gives me indigestion. I trust that Judge Medina will discern the real truth underlying these accusations. As for the woodpecker who sits at his left we can not expect such finesse without the aid of his glasses. [Judge Hall thereupon called for a "pair of glasses" and assured Mr. Collins that his vision was improved thereby.]

"To conclude, to render a decision in favor of the plaintiff would be as ridiculous as to compare the soul-stirring strains of a Mozart or a Beethoven to the bray of an Arizona jackass and decide in favor of the latter."

The Court being divided, Judge Hall in favor of the defendant Sommers whose guest he then was, and Judge Medina in favor of the plaintiff to whom he also was indebted for lunch, the case was dismissed without prejudice, their honors taking occasion to thank both parties and their attorneys for their impudence and frequent contempts, so beautifully atoned for in the shape of Kaiserblumes. The attorneys responded most graciously and gently assisted their honors to their respective offices.

APPROVED APPARATUS.

CONDUIT BOX.

Knickerbocker water-tight floor outlet box. Iron box and floor plate. Adjustable brass casing, for Hubbell special attachment plug. Approved July 9, 1907. Manufactured by

Lord Electric Co., New York, N. Y.

CONDUIT BOXES.

Thomas & Betts Universal pressed steel boxes, types 300-S, 320-S, 9-S, 99-S, 7-S, 77-S, 4-S and 5-S, with covers all types. Approved July 16, 1907. Manufactured by

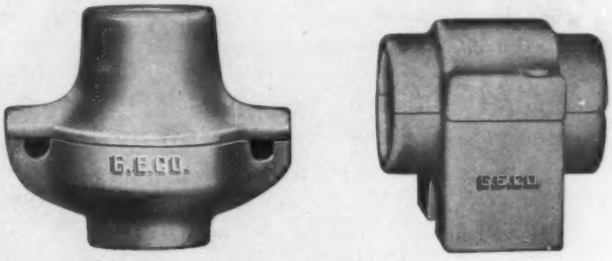
The Universal Caste & Foundry Co. for the Thomas & Betts Co., New York, N. Y.

RECEPTACLES, STANDARD.

Bryant Cat. No. 9,514. Porcelain receptacle for use in conduit outlet boxes. Approved July 16, 1907. Manufactured by

Bryant Electric Co., Bridgeport, Conn.

G. E. Cat. No. 42,454. Porcelain base, double-ended receptacle, 16 C. P., 250 V. Approved for service in show win-



dow and show case metal reflectors, only. Approved July 9, 1907. Manufactured by the

General Electric Co., Schenectady, N. Y.

SOCKETS, WEATHERPROOF.

P. & S. composition pendant, Cat. No. 60,666 and 60,-666A. Approved July 9, 1907. Manufactured by

Dickinson Mfg. Co., Springfield, Mass., for Pass & Seymour, Inc., Solway, N. Y.

Fuse Wire and Mfg. Co., Chicago, Ill.

MISCELLANEOUS.

"Spedoodle" socket plug for inside work only, 16 C. P., 125 V. A thermostatic lamp flasher for use on 16 C. P. lamps only. Approved July 22, 1907. Manufactured by

The Electric Ad. Co., Detroit, Mich.

PANELBOARD.

Jones Universal Metering Panelboard, 2 and 3 wire, 125 and 250 V. Approved for use where installed in approved steel cabinets, July 22, 1907. Manufactured by

H. Krantz Mfg. Co., Brooklyn, N. Y.

SOCKETS, STANDARD.

G. E. "Security Snap," Key and Keyless, Edison styles, Cat. Nos. 44,147 to 44,164, inclusive, 44,814 and 44,815. Approved July 22, 1907. Manufactured by

General Electric Co., Schenectady, N. Y.

ATTACHMENT PLUG, FUSELESS.

"P. & S. Swivel." 3 A, 250 V. Separable cap. Formerly marked "Sarco," and manufactured by the Sarco Company, New York. Approved July 25, 1907. Manufactured by

Pass & Seymour, Inc., Solway, N. Y.

NEWS NOTES

FINANCIAL.

San Francisco,—The Rochester Oil Company has levied an assessment of five cents per share, delinquent August 30th, sale day September 21st.

San Luis Obispo.—The Board of Directors of the Brookshire Oil Company paid another three per cent dividend on August 1. The Brookshire was one of the first oil companies to be promoted in this county.

San Francisco.—The American Oil and Refinery Company has levied an assessment of 10 cents per share, delinquent September 3, sale day October 28. J. C. Anthony, secretary, 2084 Bush Street, San Francisco.

San Francisco.—Officials of the old Geary Street, Park and Ocean Railway Company are said to be behind a suit to enjoin the Board of Supervisors from expending the fund set aside to convert the Geary Street cable line into a municipal road, for which suit papers are now being prepared.

San Francisco.—The Fire and Public Utilities Committees of the Board of Supervisors will recommend that a special election be held on November 12th, one week after the regular election, in order that the proposition to issue four per cent bonds for the construction of a water system for fire protection may be subject to the will of the people.

Redding.—The Northern California Light and Power Company has brought suit against Edward Whaley and others to condemn about thirteen acres of land owned by the defendants on the south bank of South Cow Creek. This land lies near the junction of South Cow Creek and Mill Creek, and the Northern California Light and Power Company states that it has sought to buy it from the defendants, but that the latter have refused to sell.

Tucson, Ariz.—The City Council will meet soon for the purpose of quashing the bond issue of $300,000, authorized last spring. Instead they will call an election to vote upon a $260,000 issue. The reason for this is that the consent of Congress would have been necessary for the larger issue, thus causing delay. The need for a larger water supply is pressing. J. A. Goodwin, representing the American Light and Water Company, is here to bid for the bonds.

Sacramento.—At the meeting of the Board of Equalization, the Lake Tahoe Railway and Transportation Company appeared by D. L. Bliss. Its total mileage is eighteen miles in the State, and the value of the roadway, roadbed and rails is $26,767.50. In Nevada County there are 1.3 miles and in Placer County 16.7 miles. The net income is $15,112.71, as reported, and its deductions $3750, leaving a surplus of $11,362.71. Its earnings were $45,869.49, and expenses $30,756.78.

Los Angeles.—Dillon & Hubbard have passed favorably upon the proceedings in preparation for the sale of the aqueduct bonds. The first issue will be a thirty-five-year serial at 4½ per cent, for $1,050,000, so arranged that the city will pay nothing during the first five years while the aqueduct is building. A similar amount may be offered for sale next March. The Clearing House Association, in conference with the city officials, advised against any attempt to market a larger bond issue at the present time, owing to the condition of Eastern markets.

ILLUMINATION.

Anaheim.—C. A. Watson and R. J. Dunn have been awarded the gas franchise, advertised.

Pasadena.—C. C. Glass, manager of the municipal electric lighting plant, estimates that the capacity of the plant could be doubled for $800,000. If the Council approves, an election for voting bonds will be held.

San Francisco.—The supervisors' artificial lights committee took steps yesterday to restore the illumination in the burned district and also to have the United Railroads install ornamental poles on Market Street.

Los Angeles.—The City Gas Company, which is capitalized at $1,000,000, has asked for a permit to build a gas plant, with two steam boilers of 200 horsepower each. They have seven acres at Tenth and Santa Fe Avenue. F. J. Sartori is president; Randolph Miner, vice-president; J. A. Fishburn, treasurer; A. Ross, manager.

Albuquerque, N. M.—Resident Manager W. A. Budecke of the Las Vegas Light and Power Company, and the St. Louis auditor of the company have been investigating the project of an electric line from the main line of the Santa Fe through the Mora and Taos regions, with Las Vegas or Watrous as the southern terminus. Such a line would cost $200,000.

San Jose.—The special design of electrolier offered by the Joshua Hendy Iron Works has been deemed the best by the committee of merchants and property holders and its subcommittee's report was accepted and approved at a meeting yesterday afternoon. This design will cost $125 for each electrolier, and while there were slightly lower bids, the committee decided to place the contract with the Sunnyvale concern.

POWER AND LIGHT.

The election at Cashmere, Wash., resulted in favor of issuing bonds in the sum of $13,200 for construction of electric light and water systems. The Town Council has ordered the calling of bids for construction. A well will be sunk near the Wenatchee River and a standpipe erected.

The Portland General Electric Company has filed plans with the city engineer for a plant costing $200,000 to furnish steam heat to the business section of the city. Pipes will be laid first along Fourth Street, from Washington and Stark. Section to be served includes from the Willamette River to Twelfth Street, and Glisan to Taylor.

TRANSPORTATION.

Los Angeles.—The San Bernardino Interurban Railway Company has changed its place of business to Los Angeles.

San Diego.—The Keller-Kerckhoff people have asked for a franchise to construct a railroad along the water front to Del Mar.

Marysville.—The Northern Electric Railroad last week sent the first carload of freight over the new road from this city to Sacramento. September 1st has been set as the opening day for the passenger traffic.

Stockton.—The first cars over the Central California Traction Company's interurban line were run last week as far as the Hildreth place, about seven miles beyond Stockton. Two cars were put on the line, and they made 30-minute trips. Within a week the line will be completed to a point about three miles from Lodi. Work on the new line is being rushed.

Woodland.—The Northern Electric Railroad Company, it is understood, has purchased the Vallejo and Northern Electric Railroad interests. The latter road is the one which is planning to build a line from Vallejo via Suisun to Winters and Woodland, thence northward west of the Sacramento River to a junction with the branch line now being built westward from Chico to Hamilton City. The company will also build a branch line from Cement, near Suisun, to Sacramento. The latter branch will probably be the first part of the road constructed. The road has purchased the Niclas Building, at the corner of Main and Second Streets, in Woodland, for a passenger depot, and will have its power house and switching yard probably further south on Second Street.

Chico.—The Northern Electric Company's road, connecting Chico and Hamilton City, which has been in course of construction for several weeks, is now completed and ready for operation. The temporary bridge along the three miles of roadbed will now be replaced by permanent trestle work. Work of constructing a temporary bridge across the Sacramento River will be commenced in a few days, the first load of piles arriving last week. With the aid of a pile-driver the timbers will be driven in the river bed deep enough to insure perfect safety for traffic, and a 25-foot pontoon span will allow the passage of boats. In Hamilton City a $4500 set of truck scales has been erected for the weighing of beets. On the completion of the road, hauling of sugar beets will begin and the work of building a permanent track will be completed before the rainy season. At present three grading outfits are at work, employing in the neighborhood of 200 horses and 55 men.

San Francisco.—With a view to hastening the construction of the Geary Street road as a municipal system the supervisors' public utilities committee has requested the city engineer to make a report at its next meeting on the condition of the rails and roadbed and the amount of damage done thereto; also what the cost would be to construct the road under the plans covered by last year's appropriation of $325,000, and what changes he would recommend with a view to improving the plans so prepared. The Geary Street Railroad Company desires to resume service upon its road, and through its president, Horace E. Platt, has petitioned the supervisors for permission to begin running its cars again on the old tracks pending the use of the street by the city in carrying out the plan of municipalizing the road or the grant of a franchise to another company.

INCORPORATIONS.

Los Angeles.—The Canyon Oil Company has been incorporated with a capital stock of $75,000 by F. W. Hawks, Fred Grob and G. S. Chase.

San Francisco.—H. C. Holmes, G. L. Payne and J. D. Lederman are the directors of the Pioneer Midway Oil Company, recently incorporated with a capital stock of $1,000,000.

Hanford.—With T. G. Hart, F. M. Helm, Jacob Clark, J. A. McClurg, Jr., and A. W. Anderson as directors, the Gypsy Oil Company has been incorporated with a capital stock of $500,000.

San Diego.—The Imperial Water Company has been incorporated with a capital stock of $200,000 by J. M. Prim, B. F. Humphreys, Ernest Edwards, Allen Harvey and C. H. Harlan, all of Holtville.

Los Angeles.—With W. R. Gardener, D G. Lytle, L. V. Glasscock, S. W. Stewart and R. M. Lusk as directors, the Gardener Car Fender Company has been incorporated with a capital stock of $100,000.

Bakersfield.—The Ogontz Oil Company has been incorporated with a capital stock of $10,000, by P. E. Spellack, W. M. and D. D. Wallace of Los Angeles, J. D. Thompson and G. P. Cary of Pasadena. Shares are $1 each.

San Francisco.—The Monterey County Water Works has filed articles of incorporation with C. E. Green, H. G. Pratt, A. D. Shepard, J. E. Polhemus and G. E. Crothers as directors. The capital stock is $2,000,000.

Redwood City.—Articles of incorporation have been filed by the El Cerrito Oil Company, which has a capital stock of $500,000. The directors are T. R. Turner, J. H. Coleman, H. C. Ross, Jos. Levy, J. H. Doolittle, T. W. Butcher and J. C. Doolittle.

Los Angeles.—Articles of incorporation have been filed by the Santa Monica Gas and Electric Company, with a capital stock of $250,000. The directors are F. A. Crowe, G. E. Reid, A. C. Hurt, Marshall Davidson and W. L. Percey, all of Los Angeles.

Santa Barbara.—The San Miguelito Oil Company has been incorporated with a capital stock of $500,000 by R. A. Lazier, R. W. Smith, E. L. Hudson of Lompoc, H. A. Heller and C. P. Baird of Santa Maria, A. Goux and T. M. Storke of Santa Barbara.

Bakersfield.—The Bakersfield-Virgin Oil Company has been incorporated by P. J. O'Brien, W. A. Ferguson, T. A. Baker, F. Hindes, M. H. Goodrick, A. T. Skine and C. Rechnagle, with a capital stock of $24,000, of which $8700.50 has been subscribed.

San Francisco.—Articles of incorporation have been filed by the Old Mission Oil Company with a capital stock of $1,000,000. The directors are F. L. Brown, W. G. Henshaw, H. C. Stratton, V. Enginger and G. Bauman. J. W. Lilienthal is the attorney. Shares are $1 each.

TELEPHONES.

Vancouver, Wash.—D. J. Eaton, of the Home Tel. Co., is seeking a franchise in this city.

Colfax, Wash.—The city has granted a ten-year franchise to the Pacific States Tel. Co.

Oaksdale, Wash.—The Farmers' Tel. Co. is asking for a franchise from the Council.

La Grande, Ore.—The Home Tel. Co. was granted a franchise here last week to run 25 years.

Darrington, Wash.—The Farmers' Telephone Company is building a line between this place and Oso.

Kent, Wash.—Mr. Wagoner, of the Northwest Tel. Co., wants a franchise here for an automatic system.

Riverside, Wash.—The Pacific States Telephone and Telegraph Company will install a local system here.

Nelson, B. C.—The Board of Trade is agitating municipal ownership of telephones. The B. C. Tel. Co. gives unsatisfactory service.

Wapato, Wash.—Bids for the construction of a telephone line from Wapato to Fort Simcoe will be received at the latter place on August 26th.

Chilliwack, B. C.—The Chilliwack Telephone Company has been incorporated with a capitalization of $20,000, in 2,000 shares of $10 each, to establish a general telephone service in Chilliwack.

Kingston, Idaho.—Walter Clark proposes to build a telephone line from this place, connecting with the Bell system, up to the North Fork of the Coeur d'Alene, if the forestry service will grant permission.

Eugene, Or.—Telephone service in the Siuslaw country is proving unsatisfactory. Fifteen subscribers have withdrawn from the old company operating between Eugene and Florence and have formed a new association, known as the Berkeley Telephone Company. Construction of the new line has begun.

POWER AND LIGHT.

The electric plant at Cottage Grove, Ore., which was destroyed by fire with a loss of about $30,000 with small insurance, will be rebuilt at once. Mr. Welch, of Portland, is interested in the company.

Proposing to furnish the cities and towns of iKng County what additional electric power is needed for all purposes, the Tolt Power and Transportation Company recently asked permission of the Superior Court to condemn 146.5 acres of land in Township 26, Range 8 East. It is stated that the company is organized for the purpose of utilizing the water power of Tolt River.

The Westinghouse Electric Company has recently been awarded a contract from the Palace Hotel Company, San Francisco, for four 300-kilowatt, 3-wire, 250-volt, 150 revolutions per minute, engine-type generators, together with four generator panels and nine feeder panels. Each feeder will be protected by an automatic circuit breaker, mounted on feeder panel. The complete electrical equipment will be installed under the supervision of the Westinghouse engineers at this office.

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Allis-Chalmers Co.
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Annunciators
California Electrical Works.
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California Electrical Works
Gould Storage Battery Co.
Standard Electrical Works

Batteries, Storage
Western Electric Co.
Century-Klein Electric Co.
Gould Storage Battery Co.
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Boilers
Henshaw, Bulkley & Co.
Moore, C. C. & Co., Inc.
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Northern Electrical Mfg. Co.

Building Material
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Circuit Breakers
Fort Wayne Electric Works
Century-Klein Electric Co.

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Rix Comp Air & Mach. Co.
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Conduits
American Circular Loom Co.
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Conduit Fixtures
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Northern Elec. Mfg. Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co
Wagner Elec. Mfg. Co.

Elevators
Van Emon Elevator Co.

Electric Car Heaters
Johns-Manville Co., H. W.
Northern Electrical Mfg. Co.

Electric Grinders
California Electrical Works
Northern Electrical Mfg. Co.
Tel. and Elec. Equipment Co.

Electric Heating Devices
Johns-Manville Co., H. W.

Electrical Instruments
Cutter Co., The
Century-Klein Electric Co.
Fort Wayne Electric Works
General Electric Co.
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co.
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California Electrical Works
Northern Electrical Mfg. Co.
Standard Electrical Works
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Electric Polishers
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Electric Railway Appliances
Pierson, Roeding & Co.
Johns-Manville Co., H. W.

Electrical Supplies
California Electrical Works
Century-Klein Electric Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.

Electric Ventilating Fans
Century-Klein Electric Co.
California Electrical Works
Northern Electrical Mfg. Co.

Engines, Boilers, Heaters, etc.
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore, Chas. C. Co., Inc.

Electric Watchman's Clocks
Tel. and Elec. Equipment Co.

Engineers, Chemical
Smith, Emery & Co.
Moore & Co., Chas. C., Inc.

Engineers, Civil
Standard Elec. Works
Tracy Engineering Co.
Westinghouse Machine Co.
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Engines, Gas and Gasoline
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore & Co., Chas. C., Inc.
Westinghouse Machine Co.
Hunt, Mirk & Co.

Engineers and Contractors
Brooks-Follis Elec. Corporat'n
Byllesby & Co., H. M.
California Electrical Works
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